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SOME RURAL STRESSES*

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IN the district outside Cambridge where I work we have no large urban population. Our patients are, for the most part, men of the soil—men of the fens. They work with their hands, with their backs, with their legs, often toiling long hours and in all weathers—in fair, in foul, in scorching heat, in icy blast. Although apparently carefree and simple, they seem to have an inborn understanding of money—and, indeed, of compensation. Like Hilton, they are firmly convinced of the value of rest; and if our treatment or advice threatens to disturb their aboriginal philosophy they can be very stubborn.

The town of Newmarket, with its racing industry, stands like an island in a sea of agriculture. Various classes of people are concerned with horses, but those most frequently referred for treatment are the stablemen, usually local men who have been in the business for years—and their fathers before them. In their work with animals they develop a remarkable trait of sympathy, and they make excellent hospital orderlies when they retire from their stable duties.

I wish to indicate some of the stresses to which these groups are exposed and to comment briefly on the medical aspects.

Flexion Stresses

The stress of flexion causes a heavy toll of suffering and disability. East Anglia is a land of stoopers; for tilling the soil or tending animals always involves bending, lifting, and carrying. A drive on any of our

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country roads would soon convince you that the spine bears the brunt of the stress. You would see the bent backs of workers using the hoe, tending sugar-beet crops, or cultivating vegetables and flowers for Covent Garden; the bent backs of men who drive tractors and farm carts; the heavy flexion strains of men forking beet, loading hay, and lifting potatoes; and the flexion stress of lifting combes of corn and pails of water, of mending fences and clipping hedges. It is not surprising, therefore, that lesions of the lumbar intervertebral disks are common in agricultural workers.

I believe the younger and apparently stronger men are more prone than their older colleagues to develop acute disk lesions. It may be because their disks are more elastic and therefore generate a greater expulsive force; or simply because they attempt heavier tasks, as young men are apt to do. Perhaps the older workers have already lost their disks in the days when lumbago and sciatica were not fashionable and relief was quickly obtained by using a lotion made of turpentine, cloves, and chillies.

There are at least two clinical types. In the first, an aching back comes on gradually after stooping work, later becoming more severe, and finally blossoming into a full-blown sciatica. In the second the onset is explosive: the victim is fixed in flexion and back pain is very severe; sciatic radiation declares itself almost at once and is often crippling.

I should imagine that in the first group the volume of extruded disk material is relatively small, but the protracted course of the disability suggests that more and more of the nucleus escapes with subsequent stresses. In the second group the bulk of the nucleus pulposus escapes in one large juicy mass.

For the most part this second group appears to have the better prognosis, for the whole intervertebral complex settles down without the disturbance of repeated small extrusions, and the effects of root pressure are soon relieved by shrivelling or by laminectomy. The less dramatic symptoms of the first group do not impress the patient—or his doctor—with a sense of urgency for bed rest, plaster immobilization, or even manipulation; but unfortunately repeated fresh episodes lead to a protracted traumatic inflammatory reaction, with the formation of dense adhesions about the nerve roots. These periradicular adhesions are no myth: they are there to be seen if the lamina is removed, and I believe they are of great importance in many cases of prolonged disability after disk lesions. Many of these patients bear radiological evidence of previous disk disturbances, and one may often be fairly certain that the new lesion is not at the level of the narrow intervertebral space. This point has been repeatedly shown by myelography and at operation.

My observations lead me to attach rather more importance to sacralization and to asymmetry of the lumbo-sacral facets than do some of my

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colleagues. Rightly or wrongly, I believe these anatomical anomalies cause a degree of fixity at the lumbo-sacral level which renders the lumbar spine less efficient in flexion. The lumbo-sacral disk is frequently narrower in these conditions, not because it has suffered prolapse, but simply because there is less demand for the disk mechanism at a site of diminished mobility. Extra duty, however, is demanded at L4-5 and even as high as lumbo-dorsal levels—and trouble often follows.

The older men from the fields nearly always show their flexion stresses in the form of anterior osteophytic bosses in the dorsal spine and lateral bosses at lumbar levels. Such outgrowths do not occur when there are healthy turgid disks which "float" the vertebrae away from one another; but they do occur when the disk loses its resilience, or is reduced in volume by rupture through the annulus fibrosus. The bony beaks we so often see in radiographs are, I think, a normal structural response to altered mechanics, and they bear witness to the remarkable adaptability of the body, even in old age. Similar changes occur at the knee in genu valgum, where a great spur may develop from the medial tibial condyle to provide greater stability for the abducted knee. A comparable out-growth is sometimes seen at the upper margin of the acetabulum in an adducted hip. Such changes have the same significance as the prop the farmer places under his leaning haystack; and if, as sometimes happens, the superincumbent load partly overflows the prop, it is, within limits, a more efficient support. In the same way lipping of the vertebrae is an attempt to achieve stability where the normal mechanism has become imperfect. In the kyphotic curve of the dorsal spine gravity provides a constant flexion stress on the anterior parts of the vertebral bodies, and we should expect to see some buttressing in front. If for any reason the body is unable to make the necessary osteoblastic response, we find wedging and collapse, as occurs in myelomatosis, senile osteoporosis, and secondary carcinoma.

The anterior borders of the lumbar vertebrae are better disposed to withstand the forces of flexion because of their normal lordotic curve; but in walking, working, and resting, very strong lateral flexion stresses are transmitted through the sides of this segment of the spine, and the structural response is seen in lateral buttresses.

The older men certainly have their acute sciatic episodes, but their disability is generally less severe. Occasionally, however, their attacks are very acute, and I can recall two occasions when laminectomy revealed nothing but enormously thick ligamenta subflava and dense radicular adhesions. Both cases were dramatically relieved by removal of the laminae and the hypertrophied ligaments. It is very difficult to accept hypertrophy of the ligamenta subflava as a cause of sciatic pain; yet the hypertrophy of this tissue is probably a response to excessive flexion strains, and the increase in bulk could well reduce the size of the spinal

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canal to such an extent that a relatively small disk protrusion might cause quite severe effects.

Lambrinudi drew attention to a relationship between spinal stress and tightness of the hamstrings; and it is certainly a common experience to find that flexion of the spine with the knees extended is a much more severe strain than with the knees flexed. I think this is a point of some significance in land workers, who do so many tasks with extended knees.

The lightly built, wiry stablemen also suffer similar flexion stresses, but they are, I think, less prone to lesions of their intervertebral disks. Certainly in their mounted posture their spines are flexed in a long, smooth curve from buttocks upwards, and their flexed knees spare them from the more severe strains of the agricultural worker. Their flexed shoulders are repeatedly tugged by the reins, and I imagine the main stresses are fairly evenly distributed throughout the paraspinal and parascapular muscles, trapezius and latissimus dorsi, and the small posterior joints over the greater part of the spine. It is quite common for these workers to suffer from pain in the scapular muscles, in the lumbar region, and in the buttocks. Sciatic radiation often occurs, sometimes in both legs, but this picture is seldom accompanied by signs of root pressure. Their pain, one assumes, has its origin in the soft tissues and in joints; it is not a true radicular pain.

"Acute sprung back" is a flexion injury which is exceedingly rare in this district. It is inclined to occur when two men are loading a heavy weight on to a vehicle. One man's grip fails, and the entire load is suddenly and unexpectedly borne by the other, who suffers heavy flexion stress. Pain and tenderness are sited typically, over an interspinous ligament low down in the lumbar region, and, although this is a disabling injury, the prognosis is generally good if the patient is protected from further flexion stresses, however slight.

Flexion stress in the cervical spine is common in all these groups, as indeed I believe it is in all mankind. Few active men reach their middle and later years without anterior buttressing at cervical levels, which I interpret as a structural response to flexion of the neck—one of the commonest movements of man. Many men develop brachial neuralgia with evidence of irritation of the roots of C6-7, presumably the result of cervical disk protrusion.

Even greater numbers of people in their middle years develop a mysterious stiffness of the shoulder, often without antecedent traumatic incident. This is especially true of farm workers who have been confined to bed for an illness. I think many of these stiff shoulders have their origin in the cervical spine, and bed posture may be an important factor. In country districts people commonly sleep on feather mattresses into which the body sinks. With two or three pillows the cervical spine is

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forced into strong flexion or lateral flexion, placing the most mobile part at C5-6 under great strain. It is not hard to picture the reaction at the apophysial joints, and indeed in the rather flimsy annulus fibrosus; nor is it surprising that the roots of C5, 6, and 7 suffer. As the innervation of the skin and the muscles about the shoulder is almost wholly from the C5 and 6 segments one would expect to find pain and spasm in this area.

The importance of bed posture is well recognized in lesions of the lumbar spine, and our patients often tell us of their lumbar troubles when they rise in the morning. A firm mattress is one of the first therapeutic measures we think of in treating lumbar disk lesions. Bed posture is probably of no less importance in cervical lesions, and, although juggling with pillows sometimes brings dramatic improvement, it seems to be of less therapeutic value than one would expect.

Fractures of the spine due to flexion stresses occur in rural areas as elsewhere. Harvesters fall off haystacks, tractors overturn, and stablemen are thrown from their horses (one has to be very careful of terminology here—a stableman may “have a fall”, “take a fall”, or “be thrown”; he never “falls off” his mount). These fractures have no local peculiarity.

Flexion stress in the upper limb is fairly commonly met with in the form of bicipital tendinitis and rupture of the long head of biceps. In the fields bicipital tendinitis follows hoeing, lifting combs of corn, hay-making, and pulling beet; in the stables it occurs when a man holding a halter has his arm suddenly jerked as the horse tosses its head. Pain at the shoulder is apt to be diffuse, but tenderness is localized over the long head of biceps. Extension of the shoulder, as in thrusting the arm into the sleeve of an overcoat, is most painful. Dramatic cure of this condition often follows infiltration with procaine.

Rupture of the long head of biceps, occurring as it does in older men, is in part a degenerative process. Though it may be preceded by a typical tendinitis syndrome, it is often surprisingly silent, and its discovery is frequently accidental, the patient being unaware of the characteristic change of outline in the upper arm.

Extension Stresses

I shall mention only two extension stresses, and they are relatively uncommon.

The first is an acute back strain occurring when a man is in the act of pulling on a tree root or lifting some tractor attachment out of a furrow or ditch. The erector spinae muscles are contracting against an unyielding force, and the man feels a tearing sensation with acute back pain. Tenderness is found over the paraspinal muscles, and there may even be some bruising. This injury is very similar to sprung back mentioned earlier;

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but I think the mechanism differs and the period of disability is usually less. The second occurs at the wrist in the season for pulling beet, when there is an epidemic of tenosynovitis of the wrist extensors. It is partly due to stretching of tendons and mesotendons within the sheaths, and partly to friction in using the beet-hook with which the leaves are chopped off. A plaster slab usually puts matters right, but a few cases go on stubbornly for months. Although there may be pathological causes for this—such as thrombosis of vessels—one is inclined to suspect that the patient has been unable to resist the temptation to earn good wages while the season lasts.

Exposure to Cold

Exposure to cold is a further hazard of agricultural workers. The chief victims are the men who tend sugar-beet crops, but tractor-drivers also suffer. A few youngish men are seen who already have a vasospastic state—perhaps early Buerger's disease or simply an abnormal sensitivity to cold; but most of the sufferers are men of forty or more with arteriosclerotic vessels and a somewhat diminished vascular flow.

Sugar-beet workers trudge about in ice and snow, usually wearing Wellingtons, which are much less effective than heavy leather boots in keeping out the cold. Furthermore Wellingtons seriously impede foot and calf function, so that the distal circulation, losing the important assistance of the muscles, becomes less vigorous. Working in the open fields, with their feet all the time in contact with refrigerator conditions, these men tend to develop a severe vasospasm with peripheral ischaemia, which may lead to permanent damage to capillary endothelium. The circulation in the hands can be stimulated by changes of posture, by flapping the arms about the body, and by the warmth of pockets; but the feet are obviously less readily revived, and minor degrees of frostbite occur frequently. In successive seasons these patients tend to suffer more acutely, perhaps with small areas of necrosis; but acute frostbite gangrene is very rare.

Tractor-drivers are younger men as a rule, and, although they are less often in contact with ice and snow, their feet are dependent, the calf muscles are inert, and icy draughts blow up from under their machines to chill the pools of stagnant blood in their feet.

My impression is that Buerger's exercises, and perhaps short-wave diathermy to the abdomen, are far better palliative measures than the various vasodilator drugs; in the older men the effect of lumbar ganglionectomy often provides benefits which surpass my expectation.

Injuries by Direct Violence

Injuries by direct violence tend to vary with local conditions and occupations, and there is always a sprinkling of animal accidents in rural

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districts. I shall confine my remarks to injuries deliberately inflicted by animals, for they tend to follow distinct patterns.

A horse attacking a man in front tends to seize him by the shoulder or upper arm. The bite appears to be inflicted with a peculiar sideways movement of the jaw which is liable to sever the biceps, the brachial artery, the radial nerve, and perhaps the triceps. I have even seen a fragment bitten out of the humerus. The rearward attack with the hoof is aimed with great malice at the groin or the thigh; and I have seen the inguinal canal unroofed and the spermatic cord scooped up from its bed in this way. The haematoma resulting from a kick on the thigh is frequently of large size, and it is a surprisingly disabling injury. Another trick, I think as often premeditated as accidental, is for a horse to stamp on a man's toe, leaving the victim with a shattered phalanx or metatarsal shaft.

Cattle attack the trunk, and although I have no experience of serious "gore" wounds, I have met fractures of the spine, ribs, and clavicle.

A boar is, in my experience, the best anatomist among the animals, for he has an uncanny habit of thrusting his tusk into Hunter's canal. I recently had such a case where there was a ghastly slash which completely divided the rectus femoris and, after penetrating the vastus intermedius, exposed Hunter's canal. Fortunately the femoral vessels were thrust harmlessly aside. After felling his man, this boar gave him an upward jab in the gluteal fold which tore the pyriformis and missed the sciatic nerve by the "skin of a tusk"; as a parting shot he tried to tear the hamstrings across in the middle of the thigh, but failed to go quite deep enough.

In the last month I have had two elderly women in my ward with fractures of the femoral neck. One was knocked down by a resentful cow at milking time; the other was seized at the shoulder by a playful donkey and dumped in the field.

Tractors sometimes develop a similar intelligent malice. The one example I shall quote is of a driver who was "thrown" from his tractor. As he fell he wrenches the steering-wheel into full lock. The rear wheel ran over and fractured his leg, and as he lay thus crippled the tractor continued to go round in circles, running over him at each circuit.

The Return to Work

One of the most difficult problems we have to face is to get our patients back to work. There is practically no such thing as light work or part-time work on the land; and, unless he is quite fit, our patient is of little use for employment. The weakened back soon gives trouble after a day of stooping. The painful shoulder, the tennis elbow, the unstable knee, and the healed fracture always give rise to discomfort

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if outdoor work is begun before resolution is really complete, before weak muscles have been thrashed back to full power, before compensation has been settled. Even then the man may have to wait until he hears the summons of the "spirits of the fen".

We all know from personal experience that we could face office work or bench work quite soon after an illness or injury, but we could not face a full day in our own gardens, thrusting and heaving with a spade, lifting loads of weeds, sawing at branches in awkward positions, or bending over furrows to plant seeds. These patients have my sympathy.

On the other hand, it is quite extraordinary how an agricultural worker can drift on at his job with appalling disabilities—and manage somehow. Yet if you take him from work and make him much better you may have the greatest difficulty in getting him to go back. So we are faced with a paradox—a man may *continue* to work when he is unfit, but a man cannot *return* to work unless he is 100% fit. Although this problem may have a partly physical basis, there are often much wider and more complex factors in the background which I do not intend to discuss. It will suffice to say that one should not break the rhythm or the chain reflexes of work without very good cause.

Summary

In East Anglia most occupations involve constant bending, lifting and carrying. In consequence disabilities due to flexion stresses are frequently encountered.

The younger men are more prone than the older to develop acute disk lesions of which there are at least two clinical types; in older men osteophytosis of the spine is common. Bicipital tendinitis is a consequence of flexion stresses in the upper limb.

Extension stresses, which are relatively uncommon, include acute back strain and tenosynovitis of wrist extensors.

Exposure to cold and wet is a hazard of work in the fields in winter time, and minor degrees of frostbite are common.

The problem of return to work after recovery is difficult, there being practically no such thing as light or part-time work on the land.

THE MEDICAL USE OF LIGHT SOURCES*

By PHILIPPE BAUWENS

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THE scientific approach to medical problems has gained much ground in recent years. Empirical application of a remedy is frowned upon and statistical evidence of efficacy has become *de rigueur*. With some therapeutic agents, as with some disorders, it is extremely difficult to carry out controlled experiments with a view to obtaining the necessary figures for objective assessments. That is, and has been, the position in regard to the therapeutic use of light and associated radiations.

Difficulty of evaluation, however, is only part of the answer to the question, "Why has this form of treatment gone out of favour?" Other important reasons are the advent of new forms of treatment, such as that of lupus vulgaris and rickets by calciferol (vitamin D), and the introduction of antibiotic drugs in the treatment of infections. To these must be added the suspicion created by the volume of extravagant claims coupled with the negative results of objective experiments instituted to verify certain of these claims.

But in my opinion even the above do not fully explain the almost total eclipse of phototherapy. I contend that the progressive changes in the sources of radiation used in medicine, as described below, together with the misplaced reliance on the production of erythema, have directly contributed to its fall from grace.

Carbon Arc versus Quartz Mercury Vapour Burner

The modern history of light therapy began at the end of the last century with the work of Finsen, Bernhard, and Rollier. In an attempt to obviate the drawbacks of variability in sunlight in Denmark, Finsen turned to artificial sources of radiant energy. At that time the only possible substitute was the carbon arc lamp with all its attendant disadvantages. Soon there followed a very serious competitor in the form of the quartz mercury vapour burner. On balance the latter appeared to possess overwhelming advantages over the former. It could be claimed that both its installation and running costs were much lower; that it was cleaner and did not pollute the atmosphere; that technique was simplified; and above all that it produced the same visible effects as the carbon arc in a considerably shorter time. Spectrometric examination confirmed that much of the energy emitted was in the biologically active portion of the ultra-violet-ray (U.V.R.) spectrum. Since it was accepted that the beneficial

* Lecture read at the Photobiology Group Meeting in London, March 10, 1956

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action of heliotherapy was due to U.V.R., there appeared to be an unassailable case in favour of the mercury vapour lamp. As a time-saver it was also superior, for it could produce an erythema in a fraction of the time required by the carbon arc lamp. Its many assets secured its immediate popularity, and apart from some notable exceptions it ousted the carbon lamp from its hitherto unchallenged position in the forefront of artificial sources of radiation.

Yet my thesis to-day is that its very success brought about the downfall of phototherapy.

Soon after I became interested in physical therapy, I visited Rollier's establishment at Leysin and the Finsen Institute at Copenhagen. I was struck by the opposition of Rollier to the use of artificial substitutes for sunlight. And by this he meant the mercury vapour lamp, for that was virtually the only equipment he employed for comparison. The staff of the Finsen Institute were equally categorical in their conviction that they were unable to duplicate their results when they substituted the mercury vapour lamp for the carbon arc. They were even opposed to the use of carbon electrodes with metallic cores, even though this substantially shortened the exposure time by increasing the U.V.R. output.

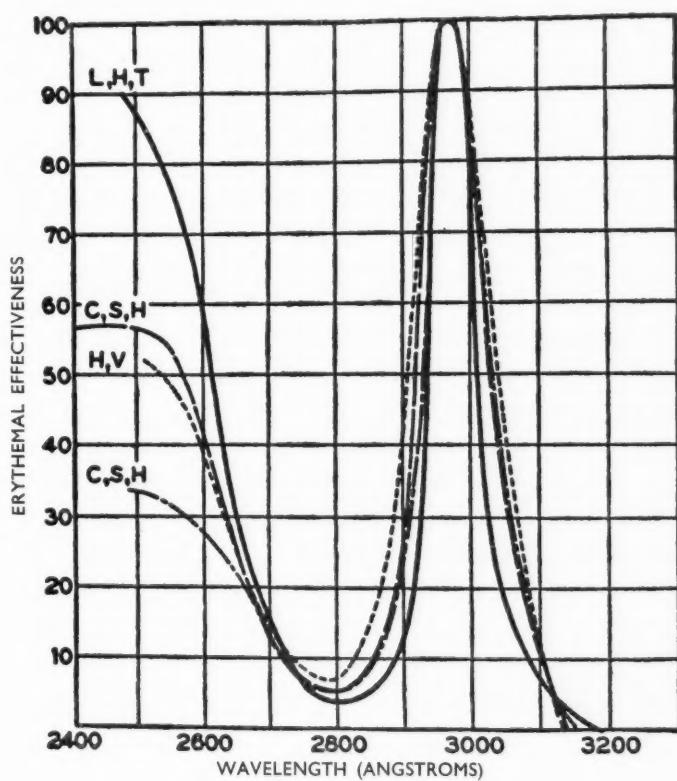
At the time I attributed these peculiarities to prejudice, but at a later date my own clinical impressions tended to support the view that results obtained with the mercury vapour arc fell far short of those obtained with the carbon arc lamp or natural sunlight.

It appeared at first sight contradictory that the more effective apparatus should prove to be of less value. The answer, I think, lies in the fact that two distinct regions in the U.V.R. spectrum produce erythema—the one around 2970 Å and the other below 2500 Å. This is clearly seen from the graph opposite. A source of radiation like the mercury vapour arc with a high emission in the short U.V.R. will produce an erythema with a relatively small exposure, but this will be achieved almost entirely by the absorption of these short radiations (2500 Å). Since dosages in therapy are based on the production of a minimal perceptible erythema, it follows that when using a mercury vapour lamp the appearance of an erythema may afford a guide in respect of shorter U.V.R. but not of the longer U.V.R.

To illustrate my point, I ask you to imagine that a vegetable extract contains an alkaloid, "X", with a definite therapeutic action, and that a second extract also contains this alkaloid "X" but in combination with another alkaloid, "Y", with different properties. Because of the presence of the alkaloid "Y" and its effects it might be inadvisable or impossible to employ the second extract unmodified as an effective source of alkaloid "X". In other words, the activity of alkaloid "Y" would set a limit to the amount of alkaloid "X" that could be administered by using the second extract.

The Medical Use of Light Sources

It is my opinion that a similar situation prevails in regard to the therapeutic use of mercury vapour lamps. The erythema produced by the short waves is such that it is virtually impossible to use this source in order to administer an adequate dose of the longer waves.



Curves showing the erythema-producing values of U.V.R. for various wave-lengths as assessed by Hauser and Vahle (H, V); Coblenz, Stair, and Hogue (C, S, H); and Luckiesh, Holladay, and Taylor (L, H, T).

Production of Erythema

Before accepting this argument as conclusive, it is well to examine it in the light of the difference in the mechanism of production of the erythema in each case. For my authority in this matter I take Mullink and Rottier (1952). In a series of experiments these workers elegantly demonstrated that the U.V.R. of short wave-length (2500 \AA) are absorbed almost entirely by the corneal layer of the epidermis and in that structure

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produce a photochemical decomposition of typical proteins. It would seem that the resulting breakdown products and proteoses have marked vaso-dilatory effects even in small concentration, and this would account for the erythema after irradiation with short U.V.R. (2500 Å). They demonstrated that removal of the corneal layer decreased the effect of the shorter, while it increased that of the longer, radiations. It would appear from this that the corneal layer constitutes an essential factor in the production of any erythema by radiation below 2500 Å and a barrier in the case of radiation of 2970 Å.

I am quite clear in my own mind that where the therapeutic effect of the wave band around 2970 Å is desired to act through the skin, the mercury vapour burner should not be used unless the shorter radiations are filtered out.

Of the longer U.V.R. around 2900 Å which exist in the solar spectrum, two properties stand out: that of converting ergosterol into vitamin D and that of causing cellular death in massive doses. Treatment by the direct administration of calciferol and attention to diet has effectively replaced U.V.R. therapy in a large number of conditions due to vitamin D deficiency or where this vitamin is indicated for remedial purposes.

Defensive Properties of Skin

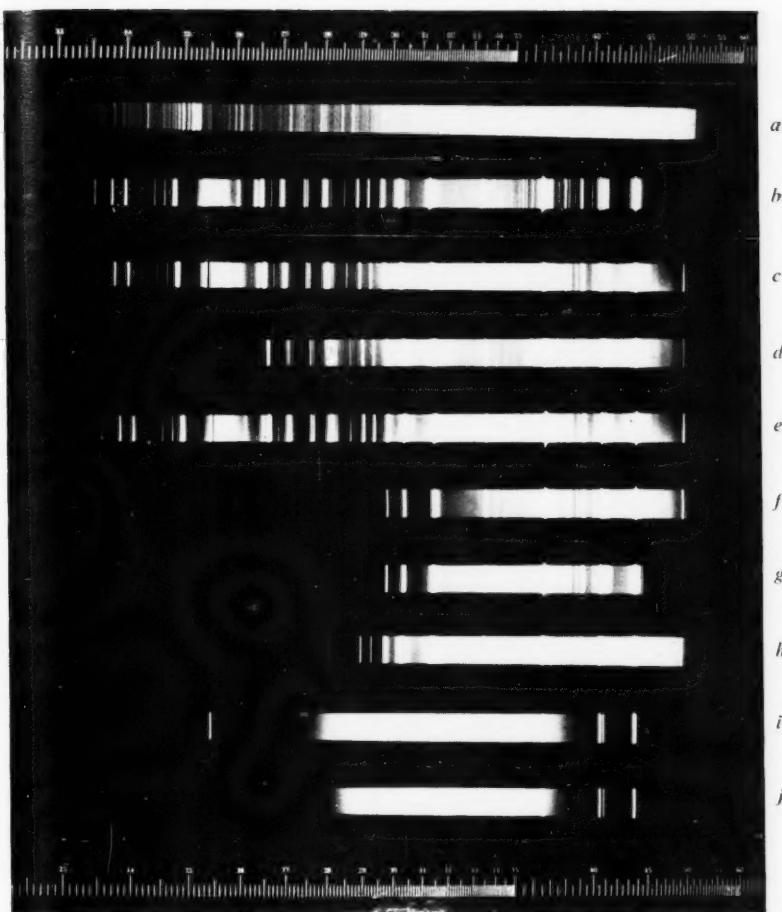
The lethal properties of radiation from light sources are of interest, for physical agents capable of causing death of living cells are, in non-injurious doses, capable of eliciting defensive reactions.

In considering the skin as the receptor of radiations, it should be remembered that this structure acts not only as a mechanical envelope to the body, but also as a vital barrier to bacterial invasion. At all events, there is evidence that it is endowed with some highly developed defensive mechanisms. Some of these result from the presence, in the superficial layers of the skin, of cells of the reticulo-endothelial system and on occasion of lymphocytes. It has been shown that such cells on provocation will produce appropriate defensive responses—ingestion of bacteria, liberation of antibodies, etc.

Hoffmann (1919) put forward the interesting idea that an esophylactic reaction could be evoked by means of U.V.R. He contended that these injurious radiations used in insulting doses produced in the living cells of the epidermis a state of defensive tension which on further provocation by a harmful agency triggered off defensive processes out of all proportion to the stimulus. In another field Sperti, Loofbourow, and Dwyer (1937) demonstrated that heavy doses of U.V.R. could in injured cells provoke the liberation of hormones which, acting on other cells, caused them to proliferate.

If vital reactions are to be obtained, it is clear that the radiations

PLATE IV



Spectrograms of various artificial sources of U.V.R., some with filtering devices. Scale in hundreds of Angstrom units:

- a* = Carbon arc lamp.
- b* = Alpine sun 5-inch tube.
- c* = Alpine sun U-tube.
- d* = New Kromayer lamp.
- e* = Original Kromayer lamp.
- f* = Original Kromayer with "cellophane" filter.
- g* = Original Kromayer with uviol filter.
- h* = Neron lamp.
- i* = Phillips sunlight tube.
- j* = Westinghouse sunlight tube.

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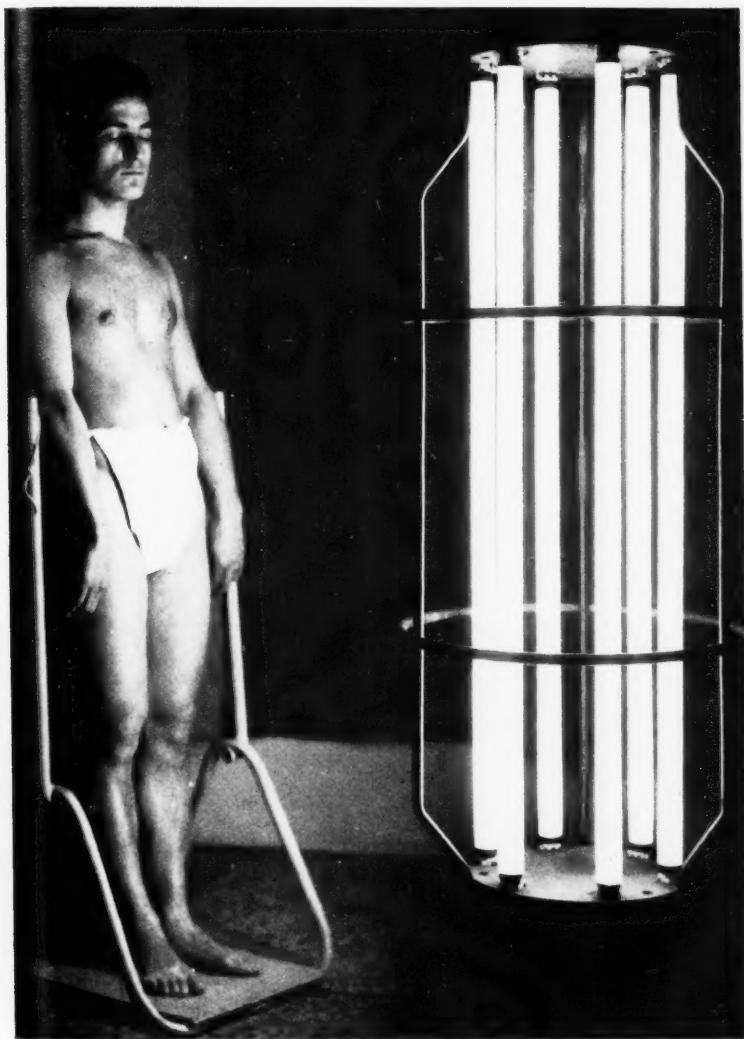
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PLATE V



Irradiation by means of carbon arc lamps—point type of source.

PLATE VI



Irradiation by means of a battery of six fluorescent 4-foot tubes—tubular type of source.

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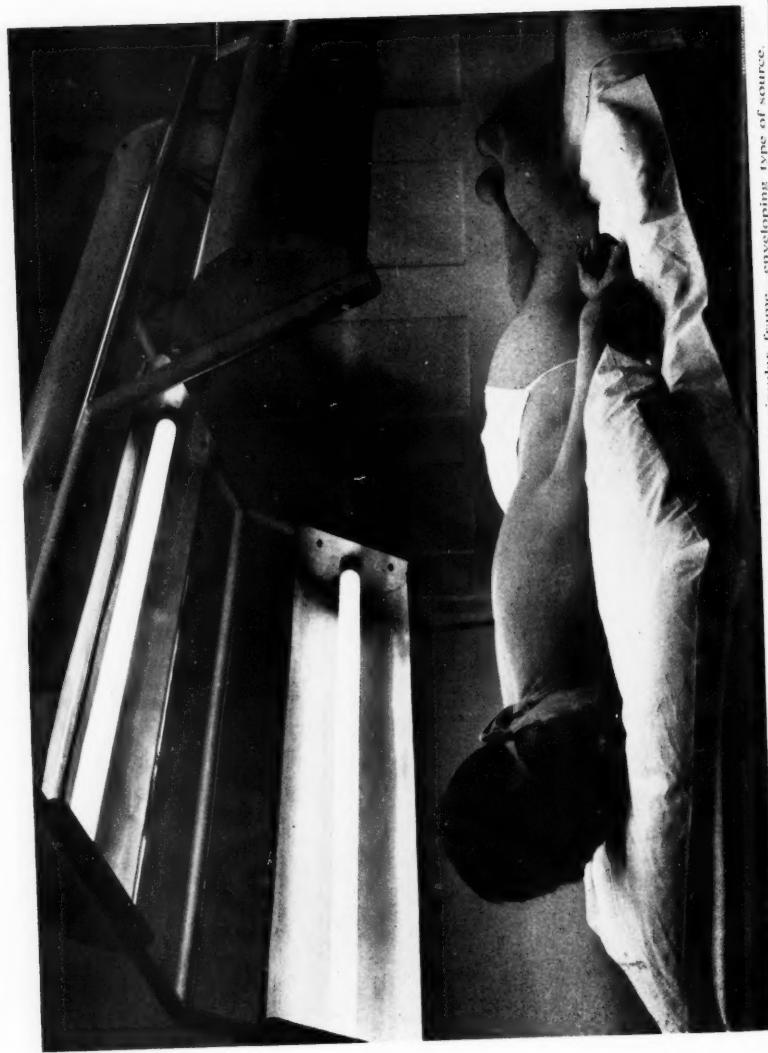


PLATE VII

The Medical Use of Light Sources

must reach living cells and must therefore penetrate at least to the mucous layer of the epidermis. Though I should be the last to dispute that waves shorter than 2800 Å may possess some therapeutic value, I would doubt their capacity to exert this without reaching cells capable of defensive reactions.

Spectra of Different Light Sources

It was once said, and it has frequently been repeated since, that a mustard plaster is as effective as U.V.R. This may well be so where the radiations emanate unfiltered from a mercury vapour lamp, but not where the erythema is produced by the radiations around 2970 Å.

Many artificial sources have been used for U.V.R. therapy, and, although each clearly has its distinctive spectrum, scant consideration seems to have been given to the fact that some sources emit in both erythema-producing wave bands, while others do so only in the wave band nearer to the visible spectrum. Plate IV shows spectrograms of ten artificial sources of U.V.R., some with filtering devices, and should be studied in conjunction with the curves in the graph on page 51.

I have lately been able to experiment with a Kromayer lamp fitted with a special burner designed to give a very high output in the long, and none in the short, ultraviolet range. Although I have not yet accumulated enough data to make a statistical analysis of the results, I already feel confident that the high content of penetrating radiations in its output is making its mark.

An interesting sidelight on these spectra is provided by the clinical sense developed by some operators in relation to the therapeutic efficacy of equipment. It was felt by a number of us with considerable experience of mercury vapour lamps that better results were obtained from long exposures to the radiations from aged burners visibly coated with tridymite than from short, but superficially equally effective, exposures to new burners. Nor was there any doubt in our minds that the old-fashioned 5-inch burner was superior to its shorter successor or to the type termed "cold quartz burner". In the light of my present proposition, these impressions appear to have had some foundations. The drift towards sources which produce erythema with ever shorter exposures by virtue of an increased output in the short-wave portion of the U.V.R. spectrum is to be deprecated.

Even Distribution of Radiation

One of the disadvantages which the single arc lamp shares with the mercury vapour lamp is the failure to obtain an even distribution of radiation over the whole surface of the body (Plate V). Whether utilizing the skin as a defensive system or as a producer of vitamin D, it must be

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obvious that the maximum area available should be exploited—not merely the restricted surface which is nearest the arc and on which the radiations impinge perpendicularly (Plate VI).

The nearest approach to the ideal consists of a battery of four fluorescent tubes with phosphors designed to emit long U.V.R. down to 2800 Å and an envelope which absorbs radiations below this wave-length. When fitted with appropriate reflectors and disposed along an arc of a circle a surprisingly even reaction is obtained on the skin (Plate VII).

Although in this age of statistics clinical impressions are suspect, I will venture to express the opinion that the results of applying long radiations evenly distributed are vastly superior to those obtained by short radiations applied to areas limited by the use of emitters of small dimensions.

Conclusions and Summary

The many advantages of the quartz mercury vapour lamp over the sun and the short flaming arc have made it a popular source of ultraviolet rays for therapeutic purposes. Its emission is, however, not comparable with that of other sources, as it has a high component of short radiations with strong biological effects. With it the use of the minimal perceptible erythema as a guide in dosage is misleading, and the eclipse of ultraviolet rays as a form of treatment may well be the result of this, just as much as the loss of interest caused by the advent of antirachitic and antibiotic preparations.

The development of high-pressure burners and of fluorescent phosphors, both capable of generous emission in the near portion of the ultraviolet-ray spectrum, calls for the revaluation of ultraviolet rays as promoters of natural resistance.

At a moment when the medical profession is becoming aware that the indiscriminate use of antibiotics has its dangers, and rightly reminds us that nature has its own way of dealing with infection and intoxication, it is perhaps opportune to recall that natural defensive mechanisms may be accelerated by some physical means, of which U.V.R. is one.

REFERENCES

- HOFFMANN, E. (1919) *Dtsch. med. Wschr.*, No. 45.
ROTTIER, P. B., and MULLINK, D. M. (1952) *Nature*, **170**, 574.
SPERTI, G. S., LOOFBOUROW, J. R., and DWYER, C. M. (1937) *Stud. Inst. Div. Thomae*, 1-163.

SHORT-WAVE DIATHERMY AND RADIO INTERFERENCE

By PHILIPPE BAUWENS and PETER STYLES

From the Department of Physical Medicine, St. Thomas's Hospital, London

Now that the television service has been extended to cover the whole of the British Isles, and radio communications and navigational aids are playing an increasing part in improving standards of safety in travel by sea and air, it is more than ever important to confine the radiation from high-frequency apparatus used for medical and surgical diathermy to allotted frequency bands in order to avoid interference with these services.

At the International Telecommunications Convention held at Atlantic City in 1947, three frequency bands, in which free radiation would be allowed, were allotted to industrial, scientific, and medical apparatus. These frequencies and their respective percentage tolerance limits were: $13\cdot56 \text{ Mc/s.} \pm 0\cdot05\%$ ($13\cdot553$ — $13\cdot567 \text{ Mc/s.}$), $27\cdot12 \text{ Mc/s.} \pm 0\cdot6\%$ ($26\cdot96$ — $27\cdot28 \text{ Mc/s.}$), and $40\cdot68 \text{ Mc/s.} \pm 0\cdot05\%$ ($40\cdot66$ — $40\cdot7 \text{ Mc/s.}$). Of the three bands, $40\cdot68 \text{ Mc/s.}$ is impracticable in this country owing to its proximity to the sound transmission in Channel 1, which is on $41\cdot5 \text{ Mc/s.}$; while $13\cdot56 \text{ Mc/s.}$ is too low to be of any value for medical use, mainly for technical reasons. Thus $27\cdot12 \text{ Mc/s.}$ (approximately 11 metres wavelength) remains as the only available frequency, and this has been accepted for medical use by several European countries and by Canada.

At first sight the problem appears a simple one—namely, to restrict the frequency of diathermy apparatus to lie within the $26\cdot96$ — $27\cdot28 \text{ Mc/s.}$ band. There is, however, a much more difficult problem, and that is the suppression of harmonic radiations which will fall outside the allotted band.

Harmonic Radiations

Harmonics may be likened to the overtones produced by the vibrations of a violin string. They are present whenever the vibrations or oscillations no longer consist of simple harmonic motion but take some form other than that of a pure sinusoid. Harmonics occur at multiples of the fundamental frequency; for example, in the case of a fundamental frequency of $27\cdot12 \text{ Mc/s.}$ harmonics would occur at $54\cdot24 \text{ Mc/s.}$ (2nd harmonic), $81\cdot36 \text{ Mc/s.}$ (3rd), $108\cdot48 \text{ Mc/s.}$ (4th), $135\cdot6 \text{ Mc/s.}$ (5th), and so on.

In this country limits for harmonic radiation have not yet been laid down, although tentative figures have been proposed by a Code Drafting

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Committee of the British Standards Institution and the Institution of Electrical Engineers. According to these proposals the radiation outside the limits of $27 \cdot 12 \text{ Mc/s.} \pm 0 \cdot 6\%$ should at no time exceed $500 \mu\text{V}$ per metre at a distance of 10 metres from the machine (54 decibels above $1 \mu\text{V}$ per metre at 10 metres).

It can be shown that the space required in the radio-frequency spectrum for the transmission of information is directly proportional to the number of picture elements transmitted per unit of time. In the transmission of television pictures in this country the number of picture elements transmitted per second is of the order of $2 \cdot 5 \times 10^6$. To achieve this the television transmission occupies $2 \cdot 5 \text{ Mc/s.}$ of spectrum on either side of the nominal vision carrier frequency. In the case of the London station of the B.B.C. the vision channel extends from approximately $42 \cdot 5$ to $47 \cdot 5 \text{ Mc/s.}$ Any signal received lying within the vision channel at the same time as a vision signal will produce an interference pattern on the screen of the receiver (Plate VIII A).

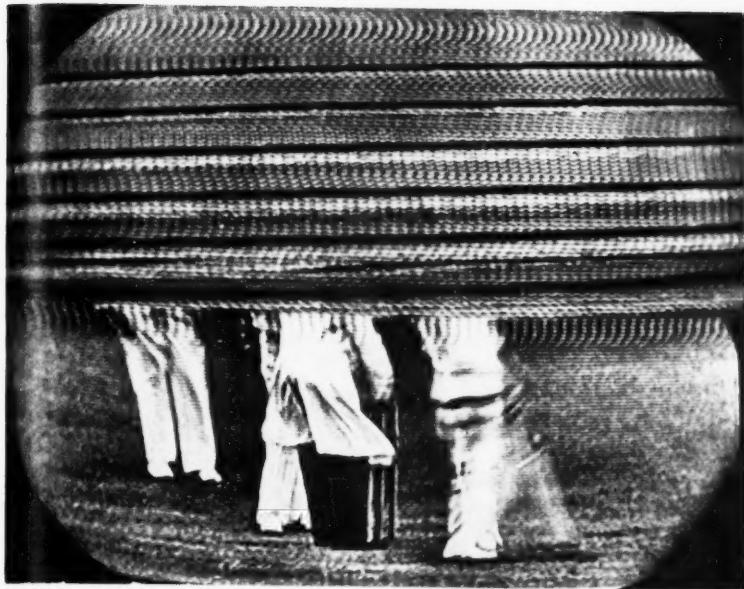
Taking $27 \cdot 12 \text{ Mc/s.}$ as the frequency at which diathermy machines are to operate, we find that the 2nd, 7th, and 8th harmonics fall within vision channels in various parts of the British Isles. The second harmonic, $54 \cdot 24 \text{ Mc/s.}$, for example, falls within the vision channel of the Kirk o' Shotts, Norwich, and Rowridge transmitters of the B.B.C. The 7th and 8th harmonics fall within Band 3, which at present is being used by the I.T.V. Authority.

The Panoramic Receiver

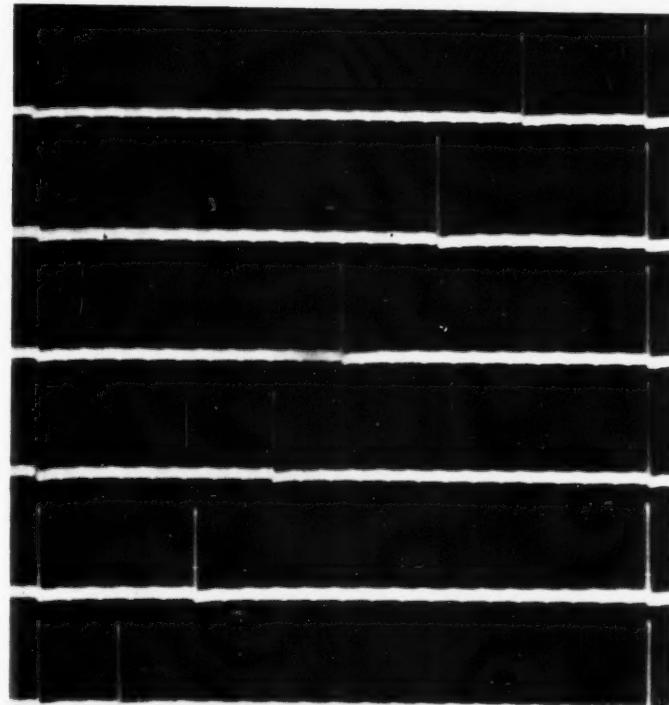
The relative position and amplitudes of the various frequencies relevant to the problem under consideration can be displayed on the screen of a cathode-ray tube, the horizontal time base of the tube being synchronized with the tuning of a receiver. The frequency to which the receiver is tuned progressively varies during the sweep from 20 Mc/s. at the left to 90 Mc/s. at the right of the screen. Each frequency received causes a vertical deflection of the spot at the position along the time base corresponding to the particular frequency. Thus a spectrum is obtained showing the distribution and amplitude of the radiation from a particular machine.

Plates VIII B and IX are recordings taken from the screen of such a receiver. Plate VIII B shows a series of recordings using three calibration oscillators to establish the frequency scale of the receiver. Plate IX A is taken with a spark-gap long-wave diathermy machine operating in the vicinity of the receiver. This machine has a nominal frequency of 1 Mc/s. , but owing to the transient nature of its output wave-form and to the instability of its frequency the harmonic radiation appears with random distribution throughout the radio-frequency spectrum. Machines of this type can

PLATE VIII

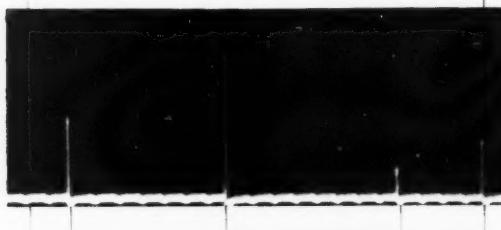
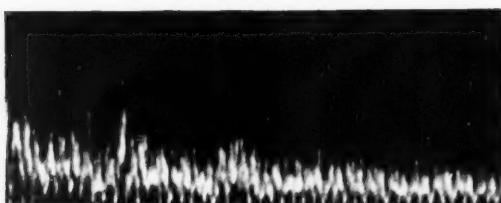


A. Interference from valve-type diathermy apparatus (unsmoothed H.T.) in T.V. reception.



B. Calibration recordings from panoramic receiver.

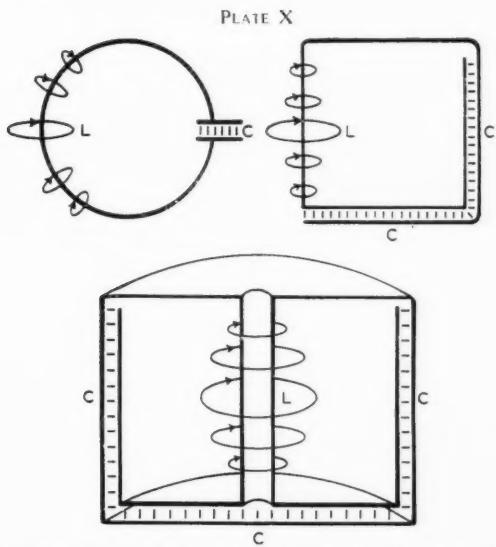
PLATE IX



20 27.12 54.24 81.36 90 megacycles

Recordings from panoramic receiver.

- A. Spark-gap diathermy. B. Portable short-wave diathermy.
C. Crystal-controlled diathermy. D. Crystal-controlled dia-
thermy, detuned. E. St. Thomas's diathermy.



A. Evolution of "pot resonator" from conventional tuned circuit. L=Inductance with magnetic field. C=Capacitance with electric field.



B. Sectional small-scale model of "pot resonator".

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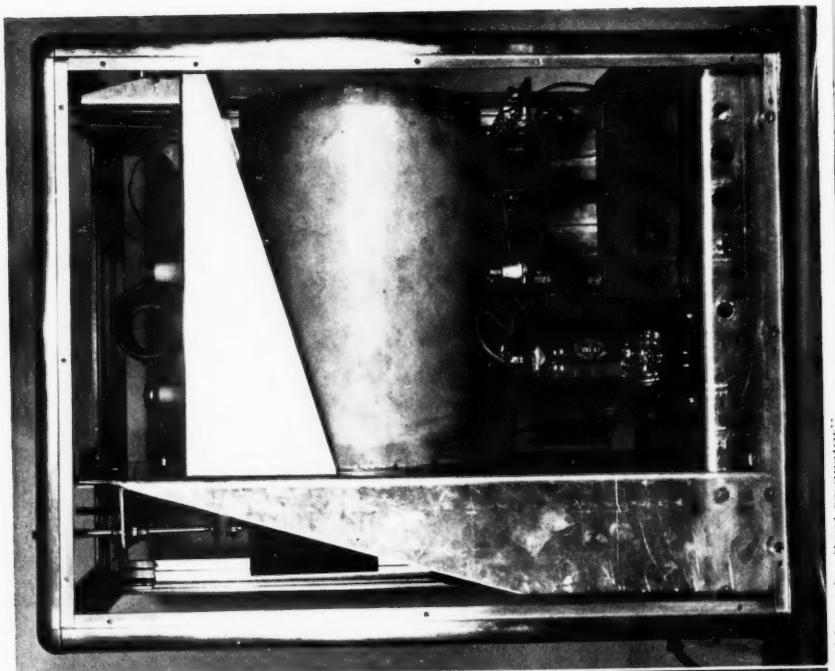
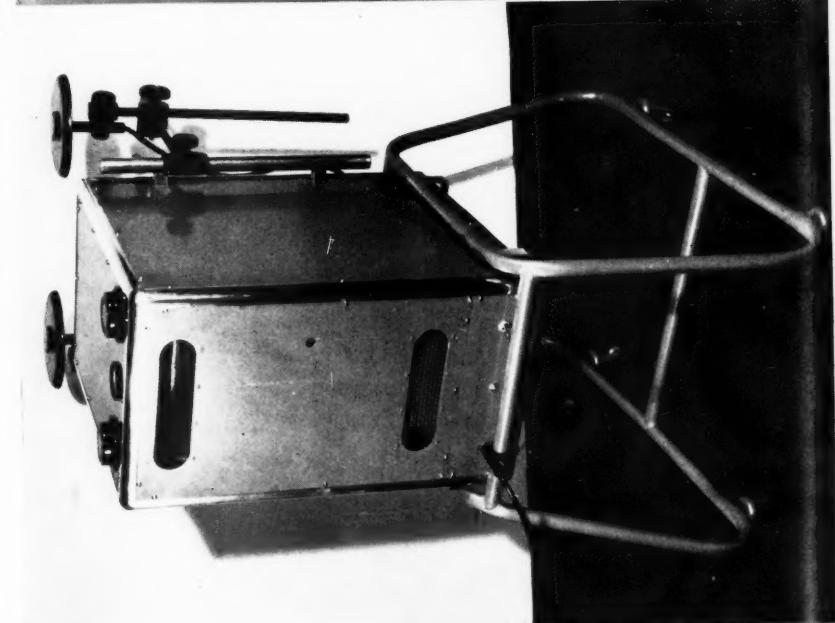


PLATE XI



Dr. Thomas' diathermy machine used "radio condenser."

Short-wave Diathermy and Radio Interference

cause interference with radio communications over an enormous frequency range, and their use, except within screened enclosures, is to be strongly deprecated.

Plate IX B is a recording made from a typical portable short-wave diathermy apparatus operating on a nominal frequency of 27.12 Mc/s. It will be seen that the 2nd harmonic radiation is greater than that of the fundamental. This does not mean that the power output of the machine is greatest at the frequency of the 2nd harmonic, but merely that the electrodes and leads are more efficient radiating aerials at this frequency.

It should be noted that in all the recordings the response at 90 Mc/s. is produced artificially as a reference. In Plate IX E the 20 Mc/s. response is also an artificial marker.

In the portable machine tested, in addition to the strong harmonic radiation, severe frequency shift occurred as the tuning of the patient circuit was varied. The frequency shift was sufficient to take the machine well outside the tolerance of 0.6% permitted. This frequency pulling by the patient circuit is common to the majority of "self-excited" machines, where the output valves function simultaneously as oscillators and as power amplifiers.

Plate IX C is a recording taken from a crystal-controlled diathermy machine operating on 27.12 Mc/s. In this apparatus the output valves function simply as power amplifiers, amplifying radio-frequency energy supplied by a quartz-crystal-controlled oscillator. The output frequency is thus made independent of the patient circuit tuning, and the frequency tolerance of $\pm 0.6\%$ can easily be achieved. The use of crystal control, however, does nothing towards the suppression of harmonic radiation, as may be seen from Plate IX C. Plate IX D shows the effect which may be brought about by detuning the patient circuit. The increase in the 2nd harmonic radiation was caused by decreasing the capacity in the patient circuit, thus increasing its resonant frequency and bringing it nearer to the 2nd harmonic frequency.

The harmonic output of a short-wave diathermy machine contributes little or nothing to the heating of the patient, since the patient circuit is not in resonance with these frequencies. Therefore the elimination of these harmonics will have no adverse effect on the efficiency of the machine; on the contrary, the efficiency may be increased, since the power radiated in the harmonics will no longer be lost.

Suppression of Harmonic Radiation

(a) *By Screening.*—A simple remedy for interference by harmonic radiation is to enclose the machine and patient in a well-designed screened room. This method was resorted to during the last war in order to prevent enemy aircraft using the radiation as a homing beacon. The use of

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screened enclosures is seldom practicable, because of the limited space available in physiotherapy departments. It is, of course, out of the question so far as portable apparatus is concerned.

(b) By "Low-pass" Filter Networks.—Theoretically it should be possible to design "low-pass" filter networks, to be incorporated in the output of a diathermy machine, capable of passing the fundamental frequency only and suppressing all the harmonics. In practice, however, on account of the widely varying types of load which the average diathermy machine has to feed, it is impossible to make filters effective without their becoming complicated and bulky. Even if suppression could be achieved by means of filters, the screening of the generator itself would have to be improved. This would almost certainly entail the use of double screening—i.e. the machine would have in effect two cabinets, one inside the other.

In spite of all these difficulties, short-wave machines incorporating the above principles have been designed and built, and the results achieved have been very gratifying. As may be expected, these machines have been developed in countries where legislation is already in force restricting stray radio-frequency radiation, notably Germany and the U.S.A. In the U.S.A. no diathermy machine may be operated outside a screened enclosure unless the type of machine is approved by the Federal Communications Commission. Similar regulations apply in Germany and to a lesser extent in Canada.

THE "POT RESONATOR"

There is a further approach to the problem of the suppression of harmonic radiation—that is, to design the power oscillator of a self-excited diathermy machine to generate a very pure wave-form free from harmonics in the first instance, rather than to filter out harmonics after they have been generated. A machine designed on these principles has been developed in the Electronics Department of St. Thomas's Hospital and appears to satisfy the requirements without undue complexity.

In order to ensure purity of wave-form it is necessary to utilize an oscillating circuit in which the losses are very small compared with the potential energy stored; at the same time the frequency stability of the circuit is improved since the stored energy is high. An approximate analogy is the use of a large heavy pendulum with low frictional losses for very accurate time measurement.

Losses in an oscillating circuit are due mainly to resistance in the coil and capacitor. These losses may be reduced by increasing the area of the coil material and by the use of dielectrics of low power factor for the capacitor. Further losses are due to radiation from the tuned circuit and consequent absorption of this power in near-by objects, and these

Short-wave Diathermy and Radio Interference

may be reduced by enclosing the tuned circuit within a screen of high-conductivity non-ferrous metal.

To meet the above requirements the St. Thomas's diathermy machine utilizes a special type of tuned circuit known as a "pot resonator", in which the inductance is very small and provided by a straight tube approximately 12 inches long by 2 inches in diameter. The capacitance is very large, being that between two concentric cylinders approximately 12 inches long by 8 inches in diameter, the annular gap being of the order of 0·2 inch. The tubular inductance is mounted inside the concentric cylinders, the inner cylinder being connected to one end and the outer to the other end by means of end-disks. In this way the field from the oscillating currents flowing in the circuit is confined almost entirely to the interior of the pot. The resonator is coupled to a normal type of power valve as an oscillator, and the output of the resonator is taken to the patient's tuning circuit via a loop coupling the magnetic field inside the pot.

Plate X A shows diagrammatically the evolution of the "pot resonator" from a conventional tuned circuit. Plate X B is of a sectioned small-scale model of the "pot resonator". The feed-back and output coupling loops can be seen. Plate XI A is a general view of the St. Thomas's machine complete, and Plate XI B with one side removed showing the "pot resonator". Below the "pot" are the mains transformer and power rectifiers, and above, the patient's tuning circuit. The oscillator valve is mounted on the end of the "pot" in a chimney to improve the circulation of cooling air. No double screening of the cabinet has been found necessary, and the harmonic radiation is well within the limits likely to be introduced in this country.

Interference with Low-frequency Amplifiers

There is another type of interference which should be mentioned—namely, that caused by diathermy machines to electro-medical apparatus incorporating high-gain low-frequency amplifiers. In this case the frequency of the radiation is relatively unimportant, the severity of the interference being related to the amount of modulation by 50 or 100 cycles per second on the radio-frequency output of the machine. In the majority of modern diathermy machines made in this country the oscillator is supplied with raw alternating current from a transformer. When this is the case, radio-frequency energy is generated only during the positive half-cycle of the supply period. If this modulated radio frequency is picked up by the input stages of an electromyograph, electrocardiograph, or electroencephalograph it may be rectified by the amplifying valves and give rise to 50 cycles per second on the final recording.

The cure for this type of interference is relatively simple. The high-

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tension supply to the oscillating circuit in the machine must be rectified and smoothed by means of condenser or choke input filters to provide direct current. Incidentally the rating of many components in the diathermy machine can be reduced with a direct-current high-tension supply for a given output.

Summary

1. International regulations covering the free radiation of radio-frequency energy are discussed with special reference to short-wave diathermy apparatus.
2. Two problems are involved: (1) to allot specific frequency bands for industrial, scientific, and medical apparatus; and (2) to confine the fundamental within, and to suppress the harmonic radiation outside, these allotted bands.
3. The $27\cdot12 \text{ Mc/s.} \pm 0\cdot6\%$ frequency band is at present the only expedient one in this country.
4. Harmonic suppression may be achieved: (1) by screening the apparatus; (2) by incorporating low-pass filter networks in the output of the diathermy machine; or (3) by substituting a very high capacity and low-loss resonator for the conventional oscillator-tuned circuit.
5. A generator utilizing a pot resonator wherein the capacitance is high in relation to the inductance while the over-all resistance is kept very low has been made and found to minimize unwanted harmonic radiation.
6. Short-wave diathermy can also cause interference with low-frequency amplifiers. The use of smooth direct current for the diathermy high-tension supply minimizes this interference.

Acknowledgment

We thank the Ministry of Health for the use of their test equipment, and the Engineering Branch of the G.P.O. for their advice and co-operation in the measurements of field strength.

THE AMERICAN CONGRESS OF PHYSICAL MEDICINE AND REHABILITATION

ANNUAL SESSION, 1955

By GORDON M. MARTIN

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THE thirty-third Annual Scientific and Clinical Session of the American Congress of Physical Medicine and Rehabilitation was held in Detroit, Michigan, from August 28 to September 2, 1955. Nearly 1,000 persons registered for all or part of the session. Scientific sessions were held both morning and afternoon on each day, and on some days two sessions were run simultaneously. Approximately sixty scientific papers were presented covering most aspects of physical medicine and rehabilitation.

Scientific Programme

The programme for the first day was sponsored by the American Society of Physical Medicine and Rehabilitation, members of which now number about 300. They voted to change the name of the Society to the American Academy of Physical Medicine and Rehabilitation. Dr. Ben L. Boynton, of Chicago, was elected president of this group for 1955 and 1956.

The panel discussions and symposia presented at the meeting, which were somewhat of an innovation on the programme, were well received. It was certainly fitting, in conjunction with this meeting in Detroit, which is the centre of the motor industry of the United States, that one symposium was on "Rehabilitation of the Injured Worker". Participants included C. L. Mitchell, M.D., chief of the Division of Orthopedics at the Henry Ford Hospital, Detroit; Charles Long, II, M.D., chief of the Division of Physical Medicine and Rehabilitation at the same hospital; B. H. Young, M.D., director of the Workmen's Compensation Board Rehabilitation Centre, from Malton, Ontario, Canada; E. A. Irvin, M.D., director of the Medical Department of the Ford Motor Company, Detroit; E. R. Bramblett, Industrial Relations Department of the General Motors Corporation, Detroit; and Mary Switzer, director of the Office of Vocational Rehabilitation, Department of Health, Education and Welfare, Washington, D.C. The need for careful co-ordination of the medical and surgical phases of the care of the injured worker with other phases of the rehabilitation programme, such as testing the capacity for work, providing for special training and placement of the injured worker, and the problems involved in placement, were discussed.

Another symposium, entitled "The Contribution of Psychiatry to Physical Medicine and Rehabilitation", was most informative. The moderator was Jack Meislin, M.D., from the Franklin D. Roosevelt Veterans Administration Hospital at Montrose, New York. Four physicians participated with Dr. Meislin in the symposium. "Rehabilitation Centres" was the subject of the third symposium, the moderator being Nila K. Covalt, M.D., medical director

Gordon M. Martin

of the Rehabilitation Centre of Central Florida, at Orlando, Florida. The nine participants in this symposium discussed frankly and in considerable detail many aspects of the existing rehabilitation centres. They included general as well as specific problems involved in the activity and management of these centres, and in this way they indicated the problems that may be encountered in the establishment of new centres.

The fifth John Stanley Coulter Memorial Lecture was given by W. H. Schmidt, M.D., of Jefferson Medical College of Philadelphia, on "Problems in Rehabilitation". He took a realistic and practical approach to the various problems, and stressed the need for better training for all physicians in the medical, surgical, psychological, and vocational management of the patient requiring rehabilitation. He emphasized that the training of physicians in the concepts of over-all rehabilitation should be undertaken during the undergraduate years in medical school.

During the first two days of the American Congress the Committee on Advances in Education sponsored an instruction seminar which provided sixteen hours of instruction by lectures. This seminar was divided into two basic sections: one on "Peripheral Vascular and Peripheral Nerve Disease" and the second on "Psychiatric and Vocational Topics of Rehabilitation". These instruction seminars were planned primarily for younger men now training in this special field who intend eventually to qualify for certification by the American Board of Physical Medicine and Rehabilitation.

Scientific Exhibits

The scientific exhibits at the 1955 meeting were outstanding. There were twenty-two exhibits covering a wide variety of diseases and approaches to problems of interest to physicians concerned with physical medicine and rehabilitation. The first prize was awarded to H. T. Zankel, M.D., R. E. Clark B.S., and R. A. Shipley, M.D., of Cleveland, Ohio, for their exhibit entitled "Venous Circulation Studies of the Lower Extremities Using a Radioactive Tracer". Other awards were made to R. L. Bennett, M.D., of Warm Springs, Georgia, for the exhibit on the "Classification of Early Paralytic Scoliosis"; and to K. G. Wakim, M.D., and F. H. Krusen, M.D., of Rochester, Minnesota for the exhibit "Effects of Electric Stimulation on Denervation Atrophy". An award for an outstanding essay was presented to Shy-Jong Yue, M.D., of New York City, a fellow in the Department of Physical Medicine and Rehabilitation at the College of Physicians and Surgeons of Columbia University, for his paper entitled "Arthroplasty of the Hip: Its Pre- and Post-operative Management".

Business and Professional Activities

Much of the business and professional activity of the American Congress of Physical Medicine and Rehabilitation concerning physical medicine and closely related fields is handled by committees. Reports given at the business meetings indicated that the majority of the committees were active during the year, and a number of valuable recommendations were made with regard to projects and activities for the coming year. For instance, the Committee on Braces, Splints, and Prostheses plans to gather information on, and actual

The American Congress of Physical Medicine

specimens of, new devices so that they can be made available to the entire membership of the Congress by an exhibit at the annual meeting, and through publication in the *Archives of Physical Medicine and Rehabilitation* of material which the committee feels has significant value. The Committee on Rehabilitation Centres reported on a survey of existing centres in the United States and recorded a summary of 130 replies which were received. This committee indicated the need for further study, relative to other types of centres and development of new comprehensive centres for rehabilitation. They have recommended official liaison with the Conference on Rehabilitation Centres, which is an organization of the medical and lay directors of rehabilitation centres throughout the United States.

Regional Reports

The American Congress of Physical Medicine and Rehabilitation now has seven regional sections which reported on their activities during the year. The majority of the sections have one or more scientific meetings at which several scientific papers are presented and informal discussions carried out. It is proposed that during the coming year some reorganization of the regional sections should be made in order to equalize the membership and perhaps permit better geographical access to meetings for a greater number of members.

Three groups whose interests and activities are closely associated with physical medicine and rehabilitation held meetings immediately preceding the sessions of the Congress. These were: (1) the American Association for Electromyography in Electrodiagnosis; (2) Study Group on Body Mechanics; and (3) another group which held a "Symposium on Ultrasound". Many members of the American Congress of Physical Medicine and Rehabilitation attended and took part in one or more of these special interest meetings.

Social Programme

The Committee on Local Arrangements at Detroit provided most interesting social and extracurricular activities for members, their guests and relatives. Visits were arranged to the manufacturing plants of some of the large motor-car companies, also to the Detroit Zoo and Greenfield Village. The last is a collection of buildings of historical and traditional interest obtained for the most part in the United States. Included are such buildings as Thomas Edison's laboratories, the bicycle shop of the Wright Brothers, a home of Stephen Foster, a Cotswold farmhouse, a Swiss watchmaker's home, a covered bridge, colonial school houses, shops, stores, and an inn.

Next Meeting

A vote at a business session instructed the delegates of the American Congress of Physical Medicine and Rehabilitation to the 1956 meeting of the International Federation of Physical Medicine to invite that organization to hold its third International Congress meeting in conjunction with the American Congress of Physical Medicine and Rehabilitation in the United States in 1960. The next meeting of the American Congress of Physical Medicine will be held in Atlantic City, New Jersey, from September 9 to 14, 1956.

CLINICAL REPORTS

ANXIETY HYSTERIA PRESENTING AS "TENOSYNOVITIS"

THE case here reported illustrates the difficulty of making a diagnosis when the history and physical signs suggest organic disease and a psychiatric illness is not suspected.

Case Report

The patient, a sergeant aged 21, was struck on the dorsum of the left foot by the ball during a game of hockey on October 14, 1955. Despite severe pain he was able to continue playing. The pain gradually became worse over the next few days, spreading to the left hallux, and he was admitted to hospital on October 19. On examination faint bruising and oedema were found over the first and second metatarsal shafts, and there was marked tenderness over the extensor hallucis longus tendon from the interphalangeal joint to the neck of the talus. No crepitus was elicited, however, at this time or later. Radiographs of the ankle and foot were normal.

The patient stated that in October, 1951, he had suffered from pain and stiffness of the left hand following a blow on the back of the hand and was unable to extend the thumb, index and middle fingers; a diagnosis of "tenosynovitis" was made and the hand immobilized in plaster of Paris for two months. In February, 1952, the symptoms recurred when the hand was injured in a cycle accident, and were again relieved by eight weeks' immobilization in plaster. Further attacks, without underlying trauma, occurred in July and October, 1952, and again in August, 1953, and on these occasions symptoms were relieved by applying elastic strapping for a few weeks.

It was decided to treat the foot by immobilization in a below-knee, non-weight-bearing plaster, and after ten days the patient was allowed up on crutches. Two days later he developed pain and swelling over the dorsum of the left wrist and hand, which he attributed to the use of axillary crutches. He was confined to bed with the hand in elevation, and injections of 25 mg. of hydrocortisone into the sheaths of the extensor indicis and extensor digitorum tendons relieved the stiffness and oedema, although the aching pain persisted.

One week later, on November 2, while still confined strictly to bed, the patient complained of pain in the right foot in the region of the extensor hallucis longus similar to that previously felt in the left foot. There was no history of injury. Examination revealed slight pitting oedema over the dorsum of the foot with tenderness of the extensor hallucis longus tendon and pain on plantar flexion of the hallux. Slight oedema was still present over the left wrist, and the extensor indicis tendon was tender. General examination proved negative; there were no clinical or radiological signs of joint disease, and none of the tendons was thickened. The results of all investigations, including estimation of haemoglobin level, white cell count, erythrocyte sedimentation rate, and blood uric acid concentration, were normal; the Wassermann reaction, gonococcal complement-fixation test, and urine analysis were also normal.

Clinical Reports

The plaster was removed from the left leg after one month, when the foot appeared perfectly normal. Within 48 hours, however, despite strict bed rest, pain, erythema, and marked oedema developed over the whole dorsum of the foot from the metatarso-phalangeal joints to the neck of the talus. On November 27 a diagnosis of atypical rheumatoid disease was considered likely, despite the normal E.S.R., and treatment with salicylates was started. The patient's condition was unchanged after five days except for the appearance of faint patches of bruising overlying the affected tendons. As the symptoms persisted it was decided to give ACTH.

The solution to this diagnostic problem was finally indicated by the patient in the next bed, who complained that on three successive nights he had been awakened by prolonged tapping noises from the sergeant's bed. This suggested that the signs and symptoms were due to self-inflicted trauma. Both arms and legs were encased in protective padded plasters and ACTH administration was discontinued. The sergeant strongly denied that he had purposely struck his limbs against the sides of the bed, but admitted he might have done so accidentally when restless during the night. However, the psychiatrist confirmed a diagnosis of anxiety hysteria dating back to the death of the patient's mother in 1951. All plasters were removed, and within ten days there were no abnormal physical signs. After a short period of in-patient psychotherapy he returned to normal duty.

Subsequent inquiry revealed that while his previous attacks in 1951 and 1952 were treated as tenosynovitis, the diagnosis was in doubt because crepitus was not elicited.

Summary

1. A man of 21 had recurrent attacks of "tenosynovitis" for four years.
2. Atypical rheumatoid arthritis was suspected because the condition failed to respond to treatment by rest.
3. Self-inflicted injury due to anxiety hysteria was eventually found to be the cause.
4. A temporary cure was effected by psychotherapy.

Acknowledgments

I am indebted to the Adviser in Physical Medicine for his advice when preparing details of this case.

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NEW APPLIANCES

A TRANSISTOR ELECTROMYOGRAPH AMPLIFIER

IT is common practice in electromyography to use a valve amplifier. This paper reports the use of a transistor amplifier for the same purpose, with several consequent advantages.

The amplifier circuit is shown in Fig. 1 (opposite). It will be seen that the only power supply required is a $4\frac{1}{2}$ -volt dry battery; as the physical dimensions of the amplifier are quite small ($9 \times 3\frac{1}{2} \times 3$ inches) the amplifier and battery are easily transported. An essential feature of the system is the use of a transformer in the input circuit, which reduces to a very low value the response of the apparatus to 50-cycle and other interference. Discrimination against in-phase signals is 100,000 : 1. Under these

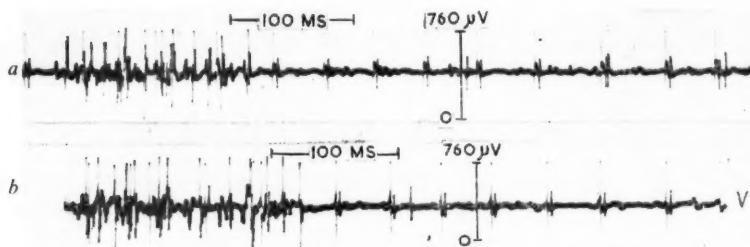


FIG. 2.—*a*, Recording made with transistor amplifier. *b*, Recording made under similar conditions with valve amplifier.

circumstances it is not necessary to earth the subject, and handling of the electrodes by the operator produces only a small artefact. The adequacy of the frequency response for clinical purposes is shown in the recording in Fig. 2 *a*, which is almost indistinguishable from that taken under the same clinical conditions with a valve amplifier (Fig. 2 *b*). The residual noise is about $15 \mu\text{V}$ peak to peak.

The transistor amplifier is almost completely insensitive to vibration, in contrast to the valve amplifier, where "microphonics" are difficult to eliminate. It is also insensitive to temperature changes within the range 18° to 25° C., and has enough amplification (approximately 180) for use with the Cossor Model 1035 oscilloscope.

The convenience of this arrangement has been well proved during the few months it has been in use at Guy's Hospital.

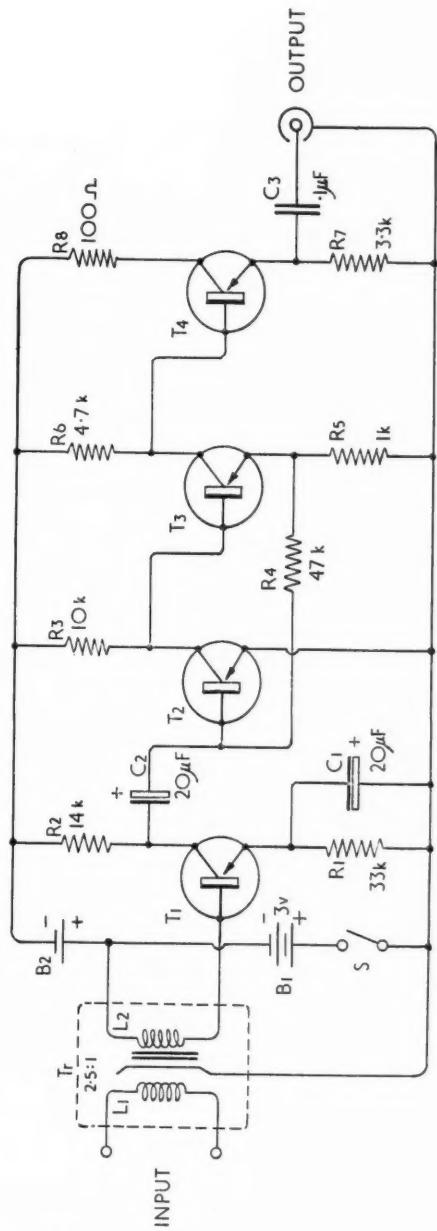


FIG. 1.—Amplifier circuit.
Tr = Fortiphone transformer, type EX 171.

L ₁	=	32 Henrys.
T ₁	=	Mullard OC 70.
T ₂ , 3, 4	=	Mullard OC 71.
R ₁	=	Wirewound resistor.
R ₂₋₈	=	1/2-watt carbon resistors.
C ₁ , 2	=	1/2-watt miniature electrolytic condensers.
C ₃	=	Waxed paper condenser.

My
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P
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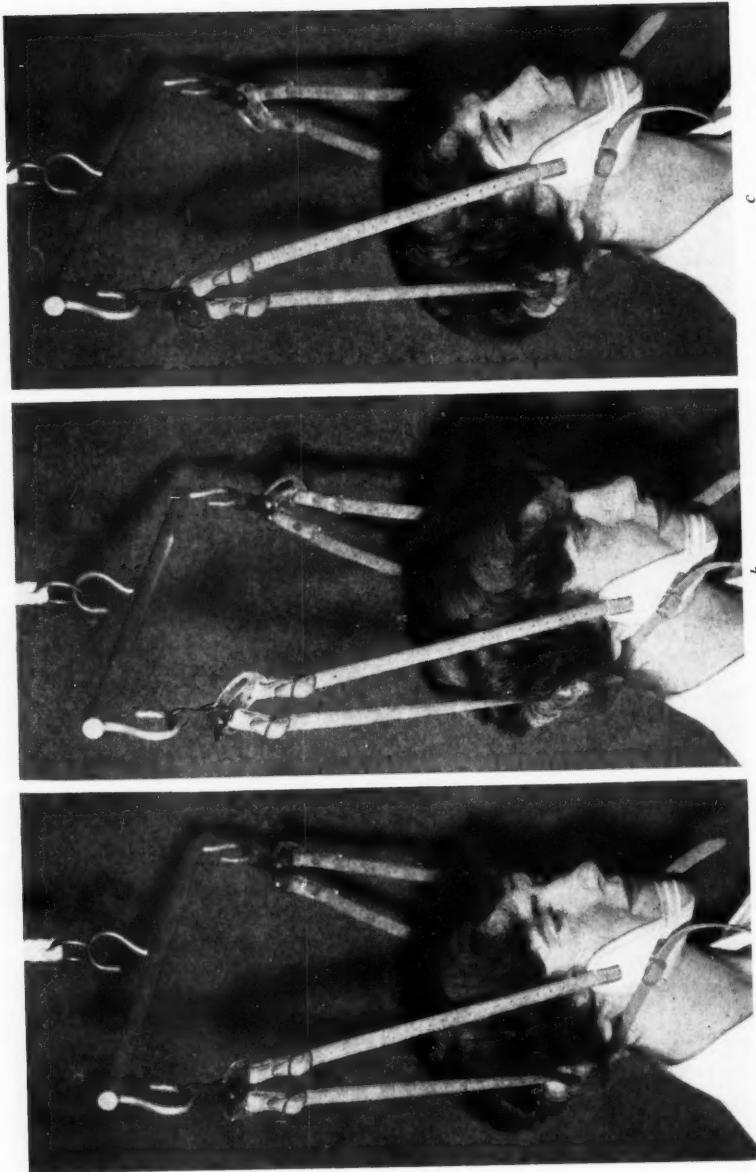
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a Adjustable head halter for cervical traction: a, normal position; b, flexion; c, extension.

New Appliances

Acknowledgments

My thanks are due to Dr. E. J. Crisp, of the Department of Physical Medicine, Guy's Hospital, for permission to use the recordings.

R. E. GEORGE

Physics Department,
Guy's Hospital Medical School,
London.

ADJUSTABLE HEAD HALTER FOR CERVICAL TRACTION

THERE is little doubt that the hands provide the best method of applying traction to the cervical spine. They mould to the patient's head and are resilient and comfortable. Manual traction, however, cannot be sustained for more than a few moments before the operator tires.

The halter described here has been designed to utilize the same principles as obtain with manual traction. The chin piece is cut to the same kidney shape as the contact points of the left hand, the connecting loop across the front representing the action of the thumb. The occipital piece has been similarly designed to approximate to the oval contact area of the right hand. The harness is constructed of very strong elastic so that it can mould itself to the part. The two contact pieces are held in position by a subauricular strap. In practice, paper handkerchiefs are placed between the patient and the harness to protect it from dirt and hair oil.

It is an advantage if traction can be applied in varying positions of flexion or extension in order that the best position may be obtained. To facilitate this, easily adjustable fore and aft spreaders have been incorporated in the apparatus. The lateral straps are in two parts, which makes possible any lateral alteration which may be necessary in the positioning of the head.

The halter shown in Plate XII has been in continuous use for over seven months and has proved more comfortable and more adjustable than other halters I have used. An added advantage is its reasonable cost.

Acknowledgments

I would like to thank Messrs. Pryor and Howard, of Mitcham, Surrey, for their willing co-operation in making this halter, and also Miss V. Green and Miss D. E. Williamson for their help in testing it.

BRYAN O. SCOTT

The Radcliffe Infirmary,
Oxford.

OBITUARY

SIR MORTON SMART, G.C.V.O., D.S.O., M.D.

SIR MORTON SMART, who died at his home at Cooden Beach on March 16 at the age of 78, belonged to that band of pioneers who did so much to establish Physical Medicine as a specialty.

Born in 1878, Morton Smart was educated at Watson's College, Edinburgh, and Edinburgh University, where his period of study was broken by his volunteering to serve as a combatant in the Highland Brigade during the South African War. After his return he qualified M.B., Ch.B. at Edinburgh in 1902, and not long afterwards came to London, where he was appointed medical officer in charge of the X-ray and electrical department at the Hospital for Sick Children, Great Ormond Street. He decided to concentrate on physical medicine and gradually left radiology, although he never lost his interest in X-ray diagnosis. His main interests in physical medicine lay in its orthopaedic aspects, and, in particular, treatment by manipulation, at which he was most skilled, and the employment of faradism—or, as he termed it, graduated muscular contractions—in the treatment of muscle and joint injuries. He was awarded the Edinburgh M.D. for his thesis on the last-mentioned in 1912 and produced his book on the same subject in 1933.

Smart rapidly built up a large private practice in physical medicine in London, and this soon included, among many distinguished people, several heads of States. His remarkably successful early career in medicine was interrupted by the war of 1914, when he volunteered to take an active part in the deployment of fast motor-boats. His knowledge of motor-boats was appreciated by Winston Churchill, then First Lord of the Admiralty, who offered him a commission in the Executive Branch of the R.N.V.R. with the rank of Commander. He had a distinguished naval career during the war, being awarded the D.S.O., and eventually becoming senior naval officer in command of the naval station at Trinidad before resuming civilian practice in 1919. Thereafter his practice returned quickly, and between the wars he was at the height of his professional success.

For many years he attended a number of members of the Royal Family. King George V marked his appreciation of Smart's services by bestowing on him the C.V.O. in 1932 and the K.C.V.O. the following year. When Edward VIII succeeded to the throne a new appointment was made for Sir Morton as Manipulative Surgeon to the King, and he was reappointed to the same office when George VI became King. He was one of the medical team called in when the King was taken ill in November, 1948, and for his services was elevated to the G.C.V.O. in

Obituary

1949, the investiture being held at Smart's sick-bed. On the Accession of the present Queen Sir Morton was appointed as Extra Manipulative Surgeon to Her Majesty, and he held this office until his death. He was awarded many other honours, including a decoration for his services to King Alfonso of Spain in 1931; he was also a Chevalier of the Order of St. Charles of Monaco.

Sir Morton was appointed an Honorary Civilian Consultant in Physical Medicine to the Royal Air Force during the last war and played an active role in this capacity. For many years his private practice was conducted at the London Clinic for Injuries, Grosvenor Square.

In addition to his book on graduated muscular contractions Sir Morton contributed a number of articles to the medical journals. He was a member of many medical societies and served on various committees, including the B.M.A. Physical Medicine Group Committee and the Central Medical War Committee. He was also a member of that small select Duchenne Society which flourished between the wars. He took an active part in the formation of the British Association of Physical Medicine, of which he was elected the first Vice-Chairman, and maintained his interest in the Association until illness prevented him during the last seven years of his life. He had many interests outside his professional work, from motor-boating to growing gladioli, and in all these extra-professional activities his enthusiasm was greatly appreciated by his colleagues, who generally elected him to high office in the appropriate association or society.

By those who worked with him, Sir Morton will always be remembered as a particularly lovable character with dynamic energy who could be guaranteed to produce a first-class clinical opinion. He was at all times willing to support and help his juniors to develop their interests in physical medicine, even if these were far beyond his own normal interests in the specialty. His passing leaves a great gap in the ranks of physical medicine.

In 1923 Sir Morton Smart married Lilian, daughter of William Gibson, who survives him.

BASIL KIERNANDER

BOOK REVIEWS

Physical Therapy after Amputation. By MARGARET BRYCE. Pp. 93. \$1.50. Madison, Wisconsin: University of Wisconsin Press. 1955.

The author is to be congratulated on producing a very interesting and useful little book explaining in detail what should be done to ensure the best functional result after amputation. The book is primarily concerned with instructions to the physiotherapist on exercises and training, but there is in addition valuable material of interest to all those engaged in the care and rehabilitation of the

Book Reviews

lower-limb amputee. A short chapter on bed positioning emphasizes particularly the danger of hip flexion contracture and how it can be avoided, and another on bandaging considers carefully the technique for helping to shape the stump. The exercises are simply and clearly explained with the help of diagrams. The author uses weight-and-pulley devices for strengthening the stump, but with this exception very little apparatus is required.

It is common experience, especially in elderly patients, to feel that had rehabilitation begun earlier a better result might have been obtained, and at the end of the book there is a useful table suggesting the time and sequence of the stages in treatment throughout recovery.

There is an excellent chapter on limps, and the causes and correction of various types of faulty gait are analysed. It might be felt that a little more stress could have been laid on the value of the timing factor and the remarkable way in which so many of the faults contributing to a limp will right themselves as soon as the patient learns to spend an equal time on each leg.

The remainder of the book gives information on the various types of prosthesis and their construction and fitting. A few more illustrations here would add a little to the clarity of the text.

Many articles may have been written on treatment after amputation, but the reviewer knows of no comparable volume in which all the physical aspects of this branch of rehabilitation are so concisely discussed in one small binding. The subject deserves careful study, and a very clear account of it is given in this book.

G. SAVILL

Modern Actinotherapy. By R. H. BECKETT, B.A. Pp. 158. 17s. 6d. London: William Heinemann Medical Books Ltd. 1955.

This little book is described as "a review of the literature, giving an outline of indications and technique". This is a fair description, and the painstaking work which has gone into its compilation is shown by the full bibliography which follows each chapter.

The book is clearly laid out and easy to read. The chapters on the physical data and physiological effects are excellent and follow naturally upon an introductory and historical outline. The state of present-day knowledge, with all its deficiencies and contradictions, is clearly reviewed and balanced by criticism. As an example, the work of Colebrook under the auspices of the Industrial Health Research Board is rightly criticized on the grounds that his criteria are almost impossible of objective assessment. Against this is set the work of Lehmann and Szakall carried out almost at the same time but leading to very different conclusions.

The chapters dealing with the application of actinotherapy in the treatment of specific conditions are less carefully critical. Taken as a whole, however, they give a reasonably balanced review of the grossly diverse views which are held in the current critical climate of medical opinion. It is clearly impossible to replace older views by anything more acceptable when these do not appear even in the recent literature. For those interested in critical research it should provide a wide field of possibilities. The book is certainly well worth reading by those who use actinotherapy.

I. H. M. CURWEN

ABSTRACTS OF THE LITERATURE

Report on Analysis Problem No. 4, set by Gilbert Ryle. *Analysis*, 1954, 14, No. 3, 51.

This issue of one of the principal journals of the linguistic school of philosophy, which is at present the dominant school at Oxford, Cambridge, and London Universities, contains a report on a problem set by Professor Ryle—"If a distraction makes me forget my headache, does it make my head stop aching, or does it only stop me feeling it aching?" There were nineteen entries from philosophers in various countries; seven competitors were clear that it is nonsense to speak of someone having a pain and not feeling it; five were clear that it is not nonsense; and the remaining seven were not definitely on either side of the fence. Professor Ryle, in his summing-up, was satisfied that there does exist a real conceptual tangle, and pointed out that "the hospitable notions of consciousness, awareness, experiencing, and knowing are the very wood-piles that hide the wanted niggers" and that "the concepts of attending, heeding, noticing, and concentrating are cardinal to the puzzle".

The position as regards counter-irritation is dealt with by one of the competitors who points out that this "does not get rid of the pain, but by directing the attention of the sufferer to an artificial irritation lessens the unpleasantness. Everyone admits that the first ache has not gone, only the attention is elsewhere." It is interesting that the winner of the third prize considered that "the answer to this question is not physiological but linguistic". The winning entry concluded: "If a distraction makes me forget my headache, it does not make my head stop aching: it only stops me feeling it aching."

[A helpful account of the linguistic problems which arise when we seek to describe sensations such as pain appears in Professor Ryle's own book, *The Concept of Mind* (Hutchinson).]

W. BARLOW

A Study of the Relationship between Radioactive Sodium Clearance and Directly Measured Blood Flow in the Biceps Muscle of the Dog. T. C. PRENTICE, R. R. STAHL, N. A. DIAL, and F. V. PONTERIO. *J. clin. Invest.*, 1955, 34, 545.

The authors observe that opinions regarding the value of the sodium clearance rate as an index of local blood flow are conflicting. A wide range of normal values is found; also there is considerable overlap between normal and abnormal, which may reflect actual variation in regional blood flow or be due to inherent errors in the clearance method as an index of flow.

A series of direct and simultaneous comparisons between total blood flow through muscle and sodium clearance have been carried out to test the accuracy of the sodium clearance method. [For details of the method used the original paper should be consulted.] Ten experiments were performed to establish correlation between clearance rate of radioactive sodium from the site of intramuscular injection and total blood flow through the biceps muscle of the dog. A linear relationship was found between these two variables. However,

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the scatter of data around the line of regression was so great that the clearance rate of radioactive sodium could not be utilized as an accurate measure of total blood flow.

In three similar experiments the biceps muscle was completely deprived of its blood supply for 75 to 80 minutes before measurements were made. Comparison of these results with those previously obtained revealed no obvious difference in the relationship between clearance and flow. These findings, coupled with the fact that the muscle was perfused with relatively well oxygenated blood, were considered as evidence that anoxia was not a significant contributing factor to the wide scatter of the data in the first ten experiments.

The results of these experiments did not support the concept that the clearance rate (under these circumstances) was solely dependent upon blood flow.

MAURICE HART

On the Number of Branches Formed by Regenerating Nerve Fibres. G. D. H. SHAWE. *Brit. J. Surg.*, 1955, **42**, 474.

It is known that during the initial stages of regeneration in a peripheral nerve each growing axon above the point of injury proliferates, giving rise to several branches which may invade the distal segment of the nerve.

The author has made a quantitative study in rabbits of the number of sprouts formed during regeneration of motor and sensory nerves. He found that a knowledge of the full extent to which the normal nerve-fibre population of a nerve is increased during regeneration could lead to a fairly accurate assessment of the chances of an adequate reinnervation of a nerve distal to any part of it damaged by injury or surgical intervention, and that the average number of branches formed by each regenerating axon could be calculated.

Figures for the number of sprouts, the level of commencement, the progress of medullation, and the difference between severance and suture and crushing have been determined. The fact that muscle nerve fibres give rise during regeneration to more branches than sensory nerve fibres has also been ascertained.

R. J. TALBOT

Tensile Strength of Nerves during Healing. S. R. MUKHERJEE. *Brit. J. Surg.*, 1953, **41**, 192.

The tensile strength of medial and lateral popliteal nerves and of sciatic nerves has been investigated to ascertain the minimum period of immobilization necessary for the sutured nerve to regain its normal tensile strength. It is concluded that adequate immobilization of the suture line after suture by fixation of the joints proximal and distal to the suture is necessary to avoid any strain (position of relaxation) and to allow anatomical union and functional regeneration. Prolonged fixation of joints may sometimes be undesirable. It has been found that the period of immobilization of a sutured nerve should be at least one month, as at this time the tensile strength of sutured nerves returns to normal. For a nerve of lesser cross-section than the medial popliteal nerve a proportionately longer time should be allowed before progressively increased joint movements are begun.

R. J. TALBOT

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The Blood Supply of the Facial Nerve. M. J. BLUNT. *J. Anat. (Lond.)* 1954, **88**, 520.

The author has studied the blood supply and venous drainage of the facial nerve in thirty human temporal bones. He concludes that there is no anatomical evidence of precarious blood supply to any part of the facial nerve below the geniculate ganglion which would specially predispose to ischaemia as a result of vascular spasm. Venous drainage is free. It is worth noting that he describes the connective-tissue sheath in the stylomastoid foramen as becoming progressively thicker and denser from above down, fusing with the carotid sheath and the connective tissue deep to the mastoid process.

W. FELL

Principles of Neuromuscular Re-education. O. L. HUDDLESTON. *J. Amer. med. Ass.*, 1954, **156**, 1396.

The author points out that the term "muscle re-education" is a misnomer, for only the nervous system can be re-educated; graded responses of either normal or paretic muscles are determined principally by the number of motor neurones acting at one time and by the frequency of their discharges. He regards maximum voluntary effort during isotonic and isometric muscle contraction, reinforcement of voluntary contraction by synaptic facilitation, the use of mass movement exercises and primitive motion patterns, and repetition as the cardinal principles of neuromuscular re-education. Some physiological evidence is quoted to support this view. The basis of clinical techniques used to achieve re-education is described.

KENNETH LLOYD

Muscle Recovery in Poliomyelitis. W. J. W. SHARRARD. *J. Bone Jt Surg.*, 1955, **37B**, 63.

This paper from the Royal National Orthopaedic Hospital analyses the recovery in 3,033 lower-limb and 1,905 upper-limb muscles in 142 patients over a period of three years. Muscle recovery was assessed by manual testing and recorded in seven grades from 0 (no contraction) to 6 (normal power).

There was surprising uniformity in the steps between grades. An upward move of one grade was accepted as the unit of recovery. The rate of recovery was found to be comparable in all muscles studied, whether in the upper or lower limb. This finding was contrary to clinical impressions, which appeared to depend on the incidence of total paralysis rather than variation in rates of recovery. The rate of recovery showed little difference in various age groups, but there was a tendency for recovery to be more rapid in younger age groups. Recovery was delayed in shoulder musculature in association with the use of abduction splints.

A detailed study of the final recovery in relation to power at one, two, four, and six months makes it possible to predict further recovery of a partially paralysed muscle from a knowledge of its grade at any time after one month from the onset of the paralysis. Lower-limb muscles showed an average increase in power of $1\frac{1}{2}$ grades from their power at two months, and of one grade from that at four months. Recovery of upper-limb muscles was, on an average, approximately half a grade greater than of the corresponding muscles of the lower limb. The important inference is that the probability of recovery is predictable at

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each phase of recovery. Fourteen-fifteenths of the total recovery takes place by the beginning of the twelfth month of the disease, and, with rare exceptions, muscle recovery is complete after 24 months.

The prognosis of completely paralysed muscles is also analysed. Of muscles completely paralysed at one month, 33% showed some recovery later. Of muscles still clinically inactive at six months, 90% remained completely paralysed; and of those that did recover, less than half achieved more than a flicker of a contraction. The prognosis of completely paralysed muscles is related to the level of recovery achieved by other muscles supplied by the same spinal segment. Deterioration of power occurred in 0·03% of recovering muscles, and was associated with the presence of strong opposing forces of antagonists or gravity.

"The key to the understanding of muscle recovery in poliomyelitis is the division of the paralysis into a 'recoverable' and an 'irrecoverable' fraction. . . . The 'irrecoverable' fraction accounts for the variability of the disease. Only when the 'irrecoverable' fraction is separated from the remainder can the true picture of recovery be analysed and the remarkable constancy of rates of recovery be demonstrated." This conception allows for a definite clinical approach, particularly concerning the optimum duration of treatment.

[This paper will be of great value to both doctors and physiotherapists who are concerned with the rehabilitation of poliomyelitis patients.]

P. J. R. NICHOLS

The Origin of Urinary Creatine in Progressive Muscular Dystrophy. J. D. BENEDICT, H. J. KALINSKY, L. A. SCARRONE, A. R. WERTHEIM, and DE WITT STRETTON, Jr. *J. clin. Invest.*, 1955, **34**, 141.

In a previous communication (*Metabolism*, 1952, **1**, 3) the authors described an experiment in which they studied the isotopic compositions of urinary creatine and creatinine excreted by a patient with progressive muscular dystrophy after he was fed glycine labelled with radioactive nitrogen (N^{15}). In the subsequent days urinary creatine was much more enriched with N^{15} -than was urinary creatinine. The isotope concentration in the creatine fell far more rapidly than did that of the creatinine. It was concluded that the creatinuria in this patient was not a consequence of leakage of creatine from skeletal muscle, but represented newly formed creatine which had failed to gain entry into muscle.

The present study is an extension of the observations on two additional patients with severe progressive muscular dystrophy. The patients were maintained on a creatine-free diet during the experiment and given N^{15} -labelled glycine. The concentrations of N^{15} in urinary creatine and creatinine were measured and compared. [For details the original paper should be studied.] The findings confirm the view that the creatine present in the urine is freshly synthesized creatine which has never been mixed with the large stores of creatine in skeletal muscle. In man most or all creatine synthesis occurs in the liver, and it is suggested that in progressive muscular dystrophy the creatinuria is a consequence of an imbalance between normal creatine synthesis and markedly diminished creatine uptake by muscle.

MAURICE HART

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The Differential Diagnosis of Flaccid Paralysis. P. H. SANDIFER. *Proc. roy. Soc. Med.*, 1955, **48**, 186.

The author considers the differential diagnosis of flaccid paralysis under several headings, discussing first the forms seen in early childhood. He points out that amyotonia congenita is not a disease but a syndrome, comprising, amongst other conditions, infantile spinal progressive muscular atrophy, myopathy, polyneuritis, congenital laxity of the ligaments, congenital universal muscular hypoplasia, congenital myasthenia gravis, congenital atonic diplegia, mental deficiency associated with hypotonia, and metabolic disorders such as infantile hypercalcaemia and infantile acidosis. In spinal cases the age at which the onset of anterior horn cell degeneration occurs determines the clinical course.

The prognostic importance of electrodiagnostic and histological aid, especially in cases which develop symptoms later in infancy, is stressed. In the secondary myopathies, differentiation between a genetically determined muscular dystrophy and a myopathy secondary to polymyositis is also of importance for prognosis. In the distal myopathies the diagnosis often rests with the pathologist.

The author points out that there appears to be a structural basis for the muscle weakness in some myasthenics, and quotes one illustrative case.

H. RHYS DAVIES

Statistical Survey of 1,000 Paraplegics. L. GUTTMAN. *Proc. roy. Soc. Med.*, 1954, **47**, 1099.

The author surveys the results of ten years' experience in the treatment of paraplegia at the National Spinal Injuries Centre, Stoke Mandeville. Tables are included to show the type of lesion and the distribution of lesions at various segmental levels. The type of material admitted to the Centre is grouped under three headings: (1) Early admission; (2) Late admission; and (3) Readmission of former patients for review or specialized treatment.

The proportion of direct deaths from paraplegia in World War II was found to be less than 10%, as compared with 80% in World War I. Of 1,000 patients, 774 have been discharged. Inquiry has shown that 22 of these were too old for work and 518 (69%) were in employment, 405 of them full-time. The author notes that many more of the remaining paraplegics are employable if the facilities were available.

H. RHYS DAVIES

Initial Treatment of Traumatic Paraplegia. L. GUTTMAN. *Proc. roy. Soc. Med.*, 1954, **47**, 1103.

The author deprecates the treatment of paraplegia with fracture or fracture-dislocation of the spine by plaster casts or beds, and advocates the use of "sorbo" packs with pillows under the site of fracture to produce hyperextension and to restore the normal curvature. The patient is turned "in one piece" every two hours by four orderlies working under supervision. Two illustrative case histories are given.

The merits and demerits of open reduction and internal fixation of the fracture-dislocation are discussed. The author does not consider that this

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method is indicated in many cases. In the management of the paralysed urinary bladder he considers that there is no place for suprapubic cystotomy, and outlines the regimen of intermittent or continuous catheterization that he employs for this condition.

H. RHYS DAVIES

Paraplegic Para-articular Calcification. G. STOREY and W. S. TEGNER. *Ann. rheum. Dis.*, 1955, **14**, 176.

Details of three cases of paraplegic para-articular calcification—two occurring in encephalomyelitis and one in cerebral neoplasm—are presented. In a series of 51 patients with chronic nervous disorders those with paraplegia due to trauma of the nervous system and encephalomyelitis appeared to be particularly liable to para-articular calcification.

G. D. KERSLEY

Multiple Sclerosis and the Local Weather. C. E. HOPKINS and R. L. SWANK. *Arch. Neurol. Psychiat. (Chicago)*, 1955, **74**, 203.

Local climatic factors were investigated for possible correlation with the frequency of episodes of disseminated sclerosis in a group of patients with the chronic remitting type of disease. The following results are reported: (1) No significant monthly or seasonal variation in the rate of episodes was noted. (2) The diurnal temperature range showed a low but significant positive relationship with exacerbations, this factor alone accounting for about 3% of the variation in such episodes. (3) Several other weather factors—temperature level, relative humidity, sunshine, solar radiation, wind velocity, and river run-off, which integrates all the weather factors—showed no appreciable correlation with such episodes. (4) The temperature changes which have the greatest effect are the maximum-minimum range in a twenty-four-hour period; mean level changes as between one day and the next have very little effect, nor does it seem to matter if the day-to-day changes are upward or downward.

This analysis thus supports the idea that patients with disseminated sclerosis suffer maximal disability in periods of rapidly changing weather, which may be unusually warm or cold. It is suggested that some small advantage is to be obtained by having patients with disseminated sclerosis adopt clothing, housing, and activity habits designed to stabilize the temperature of their environment and to prevent sudden changes in this respect.

N. R. W. SIMPSON

Fatalities and Complications after Attempts at Stellate Ganglion Block. J. ADRIAM, J. PARMLY, and A. OCHSNER. *Surgery*, 1952, **32**, 615.

The authors point out that in treating hemiplegic patients by stellate ganglion block fatalities occur from time to time even in the hands of experts in this field and in spite of all care and precautions. It is the location of the ganglion which makes the block hazardous. The stellate ganglion lies on the anterolateral aspect of the body of the seventh cervical vertebra in the space between the transverse process and the neck of the first rib; it is superior to the junction of the thyroid and the first intercostal arteries and anterior to the vertebral artery. It is accessible by a number of routes, and various techniques have been described for blocking it. The merits and complications of each of

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the three routes—posterior, lateral, and anterior—are discussed. By any of these routes it is possible to strike the pleura or blood vessels, or to enter the intervertebral foramen and introduce the drug into the peridural or subdural space.

Intrathecal injection is the leading complication causing death. This results in "high spinal" anaesthesia causing respiratory failure due to paralysis of the intercostal muscles and the diaphragm. Puncture of the pleura or lung followed by pneumothorax is not an infrequent occurrence. It may be distressing, but it is not fatal when it occurs in attempting unilateral block. It is more likely to happen when the right side is being blocked, because the pleura extends several centimetres higher into the neck region on this side. When pneumothorax occurs on bilateral block it may be fatal. The pleura is probably punctured much more frequently than is recognized, because in many instances the amount of air admitted is small and few, if any, symptoms develop.

Reactions to the drug used, caused by its rapid absorption or intravascular injection, or to intolerance, may occur and be attributed to intrathecal injection even by an experienced observer. The reaction may be convulsive or cause circulatory collapse.

The authors warn that stellate-ganglion block is a major procedure, and the operator must be prepared to meet any emergency. No block should be performed unless emergency equipment, such as resuscitator, laryngoscope, or airways, is within immediate reach.

O. F. VON WERSOWETZ

The Swedish Campaign Against Rheumatism. G. EDSTROM. *B.R.A. Rev.*, 1955, 3, 582.

The author surveys the problem of rheumatism as it exists in Sweden, and gives figures relating to the incidence of the various disorders which may be classified as "rheumatic". He states that it has been found that seven hospital beds per 10,000 of the population would be necessary for adequate treatment to be given. He then describes the steps which have been taken to provide facilities for treatment and for the teaching of both doctors and laymen.

A. C. ELKIN

Stress Factors in the Aetiology of the Rheumatic Diseases. S. J. HARTFALL. *Physiotherapy*, 1954, 40, 339.

After defining the word "stress" as used in medicine the author proceeds to discuss the general adaptation syndrome of Selye, which presumes that innumerable factors, both physical and psychological, produce stresses which evoke a complex biological change in the organism, inducing a state of "stress". According to this hypothesis stress phenomena consist of a number of non-specific systemic changes, principally hormonal and mediated through a pituitary-adrenal mechanism.

The author describes the dramatic initial effects of ACTH and cortisone and then analyses the psychological stress factors which seem to preponderate in the rheumatic affections. Of these, the highest incidence of emotional and psychogenic stress factors was found in non-articular soft-tissue types of

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disease. In 264 consecutive cases of rheumatoid arthritis the incidence of stress factors was 68%, of which 14.5% were due to acute emotional upset. Trauma accounted for 7%, drug or serum hypersensitivity or other allergies for 4%, and acute infections for 11.5%. The author concludes: "One of the most constant features of rheumatoid arthritis is an abnormality of the peripheral circulation; cold damp hands, chilblains, Raynaud's phenomenon . . . were found in 62% . . . The full impact of the notion of stress and of the adaptation theory upon clinical medicine cannot yet be assessed, but it has been a great stimulus to experimental research, and it has had and is still having a profound influence upon medical thinking."

L. D. BAILEY

Rheumatoid Arthritis in Males. W. E. MIALL. *Ann. rheum. Dis.*, 1955, **14**, 150.

In a survey of 9,430 males in a mining community, no increase in prevalence of rheumatoid arthritis was found among miners where progressive pulmonary fibrosis was prevalent. The report confirms the importance of a hereditary factor in the aetiology of the disease. The author suggests that Caplan's syndrome as well as the present findings indicate an inherited abnormality in tissue reaction, not confined to the skeletal system, in those with, or liable to develop, rheumatoid arthritis.

G. D. KERSLEY

Newer Concepts in the Diagnosis and Treatment of Rheumatic Fever. F. H. ADAMS. *J. Amer. med. Ass.*, 1954, **156**, 1319.

The importance of streptococcal disease in initiating the onset of rheumatic fever is stressed as well as the factors of hereditary predisposition, environment, and endocrine and nutritional status. The diagnostic difficulties which arise in milder cases are discussed. The value of testing the serum for acute-phase reactants is assessed, remembering that these tests are non-specific and may be positive in allied disorders.

Treatment consists in eradicating streptococcal foci with penicillin and preventing reinfection by giving 200,000 units twice a day, rest, and suppression of rheumatic manifestations with salicylates, cortisone, corticotrophin, or phenolic compounds, none of which shortens the duration of the disease. Recurrence may be prevented by administration of 0.5 to 1.0 g. of sulphadiazine daily throughout the year or by oral administration of 200,000 units of penicillin twice a day to be continued for five years or until adolescence, which ever occurs first.

[Although didactic, this article is dogmatic upon controversial "newer concepts".]

KENNETH LLOYD

Über intra-artikulare Hydrocortisonbehandlung. R. K. W. KUIPERS. *Z. Rheuma-forsch.*, 1954, **13**, 97.

Aspiration of the knee-joint may have diagnostic significance. Normally only a small quantity of clear fluid (0.5 to 2 ml.) is present, and any blood in it is due to trauma. In a traumatic arthritis or osteoarthritis the number of white cells may exceed the normal by 1,000 per c.mm.; in rheumatoid arthritis the

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white cell count may be 6,000 to 10,000 per c.mm. or more and predominantly neutrophil, while the synovial fluid may be thin; tuberculosis may give similar appearances. A complete examination should include estimation of viscosity, pH, and albumin, globulin, and mucin content; also of the intra-articular temperature and pressure.

The author finds that compound F (hydrocortisone) has a beneficial effect in many conditions, improvement taking place within a few days or weeks of its injection. A second injection should be given when pain begins to return. He uses 25 mg. for the knee-joint and 10 mg. for smaller joints, and has obtained the best results in osteoarthritic knees (60% improvement). In scapulo-humeral periarthritis he retains the impression that intravenous ACTH is more effective than intra-articular hydrocortisone.

DAVID PREISKEL

Anti-rheumatic Potency of Butazolidin in Low Doses. M. KELLY. *Brit. J. phys. Med.*, 1955, **18**, 191.

Has "butazolidin" (phenylbutazone) an antirheumatic action or is it simply analgesic? Are the benefits of its administration outweighed by the dangers of its toxic effects? In answering these two questions the author states that butazolidin is specifically antirheumatic; and that, provided patients are selected and dosage is low (300 mg. for four days followed by 200 mg. daily, giving an effective serum level of 7 to 12 mg. per 100 ml.), treatment can be pursued without danger for an indefinite period. If patients are refractory or become so he withdraws the drug for a few weeks and then tries again. He finds that several such attempts may be necessary, but when treatment is persisted in more than 90% of patients can be made to respond.

J. I. WAND-TETLEY

Horseshoe-shaped Baker's Cyst of the Knee: Report of a Case. B. M. CAMERON and F. O. MCGEHEE. *J. Bone Jt Surg.*, 1955, **37A**, 863.

In reporting a patient with a Baker's cyst of the knee with two pedicles the authors briefly review the literature since 1840, when Adams reported an enlargement under the medial head of the gastrocnemius which he thought was due to arthritis. This shows that there have been several schools of thought regarding the aetiology of this condition; for instance, that it was due to a hernia through the posterior capsule of the knee, to enlargement of the normal gastrocnemio-semimembranosus bursae, or to hernia or enlargement of the bursae. All agreed that the symptoms were usually insidious and commonly occurred in males, and that the signs were those of tumefaction and internal derangement of the knee; also that surgical excision with ligation of the pedicle, if one existed, was the treatment of choice.

In the case described a small swelling appeared after trauma and in the course of a year became much enlarged. At operation a large cyst was found in the popliteal fossa attached by two pedicles under the head of the biceps femoris and the medial head of the gastrocnemius. The authors suggest that the cyst was extra-articular, being probably an enlargement and fusion of two bursae.

J. EUAN DAWSON

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Spontaneous Ruptures of Extensor Tendons at the Wrist Joint. N. V. ADDISON.
Brit. J. Surg., 1954, **41**, 511.

Attention is drawn to cases of spontaneous rupture of the extensor digitorum communis, a little-recorded condition probably due to the fact that rupture of only one of these tendons causes little disability. It is suggested that the commonest cause is attrition on the dorsum of the hand and wrist due to a severely malunited Colles fracture or as a complication of rheumatoid-type arthritis, but that the extensor pollicis longus is usually involved. The cases quoted, of extensor digitorum communis rupture, might have been due to pathological changes in the tendons themselves. Examples are given of various diseases causing degeneration in tendon which can allow of rupture without any degree of trauma outside normal usage.

R. J. TALBOT

Chronic Mercurialism: a Cause of the Clinical Syndrome of Amyotrophic Lateral Sclerosis. I. A. BROWN. *Arch. Neurol. Psychiat. (Chicago)*, 1954, **72**, 674.

A case is described of chronic mercurialism due to accidental ingestion while treating oat-seeds with a mercurial fungicide. The clinical picture was that of amyotrophic lateral sclerosis. It is suggested that this possibility should be kept in mind in cases of combined motor-system disease, especially in agricultural workers. It is pointed out that chronic mercurialism is a neuro-toxic disorder, whereas acute mercurialism is nephrotoxic.

N. R. W. SIMPSON

Prostheses for the Juvenile Amputee. G. T. AITKIN and C. H. FRANTZ. *Amer. J. Dis. Child.*, 1955, **89**, 137.

The object of this paper is to stress the importance of prostheses for the juvenile amputee, frequently regarded as unnecessary until recent years, and to advocate the fitting thereof at an early age. The authors describe the various stages of childhood growth and development, giving their reasons for fitting prostheses as early as possible, particularly with lower-limb amputations. They illustrate six cases, in patients aged from 1 to 6 years, with and without prostheses, and claim that in all cases there has been a marked improvement in function with the prosthesis. They consider that lower-limb appliances may be fitted from the age of 12 months, but that for upper-limb amputees the most satisfactory period for fitting a prosthesis is at the 4-year-old level of intellectual and motor development, thus allowing a full year of training and acquaintance with the device before entering kindergarten.

Advice is given on when and for how long the appliance should be worn during the child's waking hours, and its various uses are described. The importance of enthusiastic co-operation on the part of the child's family and teachers is emphasized, and the value of open discussion and demonstration stressed. Attending an ordinary school is recommended for these children, as it is considered that early acceptance within a normal environment is advantageous psychologically. The authors consider that a young amputee, properly guided, will show a progressive development in skill with his artificial limb which, in varying degrees, tends to parallel his normal prehensile maturation pattern.

BASIL KIERNANDER